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LIST OF CONTRIBUTORS.

THE FISHES OF MICHAELMAS CAY, NORTH QUEENSLAND.

By

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(Plate i, figs. 1-6, and Figure 1.)

Michaelmas Cay is a small islet on the Great Barrier Reef, about twenty-seven miles due north-east of Cairns, North Queensland. It was chosen as a site for sinking a bore by the Great Barrier Reef Committee of Brisbane, and the late Charles Hedley superintended the work of geological investigation there. Mr. Tom Iredale, of the Australian Museum, and myself were the guests of Mr. Hedley on the islet from 15th May to 13th June, 1926, when we were able to make extensive zoological collections.

The kindness and many courtesies of Mr. Hedley cannot now be adequately acknowledged, since he passed away in Sydney soon after the completion of his work on Michaelmas Cay.

The members of the boring party, Messrs. Eric and Donald Duffield, T. Hughes, and M. T. Bloomer, and the cook, Mr. C. Horridge, greatly assisted in the formation of collections. Mr. A. J. Moran, proprietor of the Strand Hotel, Cairns, did much to make our stay there an enjoyable one.

Collecting.

Since an offshore wind of a dangerous character blew nearly all the time we spent on the islet, little line-fishing was done from the catamaran placed at our disposal by Mr. Hedley. Most of the collecting was done on the coral reef, which, however, was only exposed during our stay for about three days per fortnight. Here it was noticed that some kinds of fishes were found only in certain types of coral or coral-growths. *Seriatopora hystrix* sheltered *Tetradrachmum aruanum* and *Gobiodon verticalis*. *Apogon savayensis* was only found in the Staghorn Coral, *Acropora hebes*. *Chromis lepisurus* lived in schools in large clumps of coral in the deeper water between the islet and the outer reef. The relationships of fishes to corals, and whether any commensalism exists between them, would form an interesting subject for study, and might reveal a balanced evolution between some fishes and their coral shelters.

At night, Mr. Eric Duffield and I sometimes waded and speared fish by lantern-light, or scooped them into a net as they floated.

Large mullets (*Mugil crenilabis*) and garfishes (*Hemiramphus dussumieri*) were secured in this way.

A few species of fishes were washed ashore by ones and twos, but *Stolephorus robustus* was commonly stranded. Although the beach was always well stocked with resting sea-birds, none were seen feeding on them. Schools of Flying Fishes (*Parexocœtus brachypterus*) were sometimes seen over the coral reefs, and damaged specimens were washed ashore in May.

Lancelets and a new *Murœnichthys* were dredged together from a sandy bottom in two fathoms.

Fish-Fauna.

Ogilby, in 1915, compiled a list of the fishes of the metropolitan district of Brisbane[1], in which he wrote: "If similar local lists were made for the various centres of population along the coast—Maryborough, Bundaberg, Rockhampton, Townsville, Thursday Island, Normanton, Burketown—they would be of inestimable value to the Department, firstly, in enabling it to gain a clearer insight into the problems of our food supply than is now possible, and secondly, in fixing with some degree of accuracy the limit of distribution of our more valuable commercial fishes." Since the publication of Ogilby's essay a little has been done in the direction he indicated, but enough is not yet known about the distribution of Queensland fishes to enable one to say whether the Barrier Reef or the coastal waters are divisible into zones having different fish faunas, though this appears on present evidence to be a feasible supposition.

In the limited time at our disposal, about one hundred and seventy specimens of fishes were collected from Michaelmas Cay. These are here referred to seventy-two species, of which fifty-two have already been listed from Queensland, sixteen are new records for the State, and four are regarded as new.

Family EPIGONICHTHYIDÆ.

On 1st-2nd June, 1926, Mr. T. Iredale and I dredged in about two fathoms over a sand and mud area not far from the beach of Michaelmas Cay, and obtained two species of lancelets. Both species were superficially alike as they wriggled in the water or screwed their way into damp sand. One of them, however, *Asymmetron caudatum,* was recognizable on closer observation by its long urostyle. It was whitish in general colour when alive, with the intestine showing through with a pinkish colour which appeared to extend slightly along the myocommas; it had a pinkish eye-spot and a green anus, and was slightly longer than the other species obtained, *Epigonichthys hedleyi.* The latter was also whitish in

[1] Ogilby.—The Commercial Fishes and Fisheries of Queensland. An Essay, Brisbane, 1915, p. 45.

general colour with the rays giving the dorsal fin a cellular appearance. A series of green hyphen-like marks extended from about the sixth myotome for a short distance along the upper part of the side; there was a greenish sheen behind the oral region, and the intestine appeared yellowish-brown, darker, because of contained food, towards the rectum and anus. Several specimens of a worm were dredged with the lancelets, and resembled them in appearance and habits; a similar worm is mentioned by Willey as accompanying *Asymmetron* in the Louisiades; others have been collected by Mr. E. H. Rainford at Bowen and recorded from Port Phillip by Sayce (Vict. Nat., xviii, 1902, p. 152). I am unfortunately unable, however, to indicate their systematic status.

The identification of the lancelets has been facilitated by my friend, Surgeon-Commander W. E. J. Paradice, R.A.N., who kindly mounted two specimens of each species for microscopical examination.

EPIGONICHTHYS HEDLEYI (*Haswell*).

Heteropleuron hedleyi Haswell, Rec. Austr. Mus., vii, 1, 1908, p. 33, fig. 1. Murray Island, Torres Strait. *Id.* Raff, Zool. Res. "Endeavour," i, 3, 1912, p. 305.

Epigonichthys hedleyi Ogilby, Mem. Qld. Mus., v, 1916, p. 72.

Fifteen specimens (Austr. Mus. regd. No. 1A.2810); two mounted in balsam, remainder in alcohol, from Michaelmas Cay, Great Barrier Reef, Queensland.

ASYMMETRON CAUDATUM *Willey*.

Asymmetron caudatum Willey, Quart. Journ. Micro. Sci., (n.s.), xxxix, 1, 1896, p. 219, Pl. xiii, figs. 1-4; and Zool. Res. vi, 1902. p. 725, fig. 14. Deboyne Islands, Louisiades. *Id.* Parker, Bull. Mus. Comp. Zool. Harvard, xlvi, 2, 1904, p. 49. *Id.* Ogilby, Mem. Qld. Mus., v, 1916, p. 72.

Heteropleuron (*Asymmetron*) *lucayanum* Haswell, Rec. Austr. Mus., vii, 1, 1908, p. 33. Not *Asymmetron lucayanum* Andrews 1893.

Asymmetron lucayanum Raff, Zool. Res. "Endeavour," i, 3, 1912, p. 305. Not *Asymmetron lucayanum* Andrews 1893.

Asymmetron candatum (misprint) Hubbs, Occ. Pap. Mus. Zool Mich. Univ., cv, 1922, p. 16.

Fifteen specimens (1A.2809); two mounted in balsam, remainder in alcohol. Their characters are difficult to make out, but they have sixty-four myotomes and agree very well with Willey's descriptions.

Family ORECTOLOBIDÆ.

CHILOSCYLLIUM OCELLATUM (*Bonnaterre*).

Squalus ocellatus Bonnaterre, Tabl. Encycl. Meth. Ichth., 1788, p. 8. La mer du Sud.

Squalus oculatus Gray, Pisces, in King, Narr. Surv. Coasts Austr., ii, "1827" = 18 Apr., 1826 (*fide* Sherborn, 1914), append. p. 436. *Ex* Banks and Solander MS. Australia.

One small specimen (1A.2732), Michaelmas Cay; common in shallow water, under rocks, and amongst coral, where it may be caught by hand.

Gray's synonym appears to have been overlooked.

Family DUSSUMIERIIDÆ.

STOLEPHORUS ROBUSTUS (*Ogilby*).

Spratteloides robustus Ogilby, Proc. Linn. Soc. N.S. Wales, xxii, 1, 1897, p. 646. "Coast of N.S. Wales" = Maroubra. Types in Australian Museum.

Stolephorus robustus McCulloch, Rec. Austr. Mus., xiii, 2, 1920, p. 42, Pl. xi, fig. 1.

Frequently cast upon Michaelmas Cay in May-June, 1926. The Australian Museum has specimens from North-west Islet and Moreton Bay, Queensland; Port Jackson, Maroubra (types), Port Hacking, and Shellharbour, New South Wales; Queenscliff, Victoria; and off the Derwent River, Tasmania (from stomach of "Barracouta," *Thyrsites atun*).

Family CLUPEIDÆ.

HARENGULA PUNCTATA (*Rüppell*).

Clupea punctata Rüppell, Neue Wirbelth. Abyssin., Fische, 1837-38, p. 78, Pl. xxi, fig. 2. Red Sea.

Clupea quadrimaculata Rüppell, *ibid.*, p. 78, Pl. xxi, fig. 3. Massowah, Red Sea.

Sardinella lineolata Cuvier and Valenciennes, Hist. Nat. Poiss., xx, 1847, ed. 1, p. 272; ed. 2, p. 197. Trincomalee.

Harengula bipunctata Cuvier and Valenciennes, *ibid.*, ed. 1, p. 298; ed. 2, p. 216. *Ex Clupea bipunctata* Ehrenberg MS. Massowah, Red Sea.

Meletta obtusirostris Cuvier and Valenciennes, *ibid.*, ed. 1, p. 375; ed. 2, p. 276. Seychelles.

Meletta venenosa Cuvier and Valenciennes, *ibid,* ed. 1, p. 377; ed. 2, p. 277. Seychelles.

Harengula moluccensis Bleeker, Nat. Tijd. Ned. Ind., iv, 1853, p. 609. Ternate and Amboina.

Harengula kunzei Bleeker, Nat. Tijd. Ned. Ind., iv, 1853, p. 609. Ternate.

Clupea (Harengula) dubia Bleeker, Atl. Ichth., vi, 1872, p. 108. Based on *Sardinella lineolata* C. & V. Bouron.

Harengula stereolepis Ogilby, Proc. Linn. Soc. N.S. Wales, xxii, 1898, p. 759. Torres Strait, Queensland. *Id.* Banfield, Tropic Days, London, 1918, p. 184.

Clupea mizun, Kishinouye, Journ. Imp. Fish. Bur. Tokyo, xiv, 3, 1907, p. 98, Pl. xx, fig. 3. Riukiu Islands.

Clupea kunzii Günther, Fische Südsee, viii, 1909, p. 382.
Sardinella kunzei McCulloch, Rec. Austr. Mus., ix, 3, 1913, p. 355, fig. 55.

Clupea (Harengula) stereolepis, venenosa, and *moluccensis* Weber and Beaufort, Fish. Indo-Austr. Archip., ii, 1913, pp. 76-77 and 377, fig. 28 on p. 81 (scale).

Sardinella moluccensis Cockerell, Mem. Mus. Qld. Mus., iii, 1915, p. 36 (scales).

Harengula punctata Regan, Ann. Mag. Nat. Hist., (8), xix, 1917, p. 390. *Id.* Barnard, Ann. S. Afr. Mus., xxi, 1925, p. 114. *Id.* McCulloch and Whitley, Mem. Qld. Mus., viii, 2, 1925, p. 132.

Clupea (Harengula) moluccensis Delsman, Treubia, viii, 1926, p. 218, footnote.

Three specimens in the Australian Museum have the following characters:—Teeth in jaws, on palatines, and back of tongue. Forty or more rows of scales. Origin of dorsal nearer snout than caudal. Eye three in head, upper jaw two in same. Eighteen-nineteen preventral scutes, eleven-fourteen postventrals. D.ii/16; A.17-18.

Localities.—Michaelmas Cay, off Cairns, N. Queensland; found dead on beach, 17th May, 1926; coll. T. Iredale and G. P. Whitley.

Murray Island, Torres Strait (Ogilby). Giza, Solomon Islands (Prof. A. Watson).

Family ECHELIDÆ.

MURÆNICHTHYS IREDALEI, *sp. nov.*

(Fig. 1.)

Head (14 mm.) 11·6 in total length (163). Tail (84) longer than trunk (78). Depth (4) 3·5 in head. Eye (1) and interorbital

(1) 2 in snout (2). Snout to dorsal origin 83 mm. Dorsal (80 mm.) shorter than anal (84).

Head elongate, bag-like before the gill slits. Cleft of mouth extending well behind eye. Upper jaw longer than lower. A single row of backwardly curving teeth in each jaw, and along the narrow ridge of the vomer. The lateral line extends along the upper part of the head to a little behind the eye, where it divides into a short nuchal and a longer genal row of pores. Other rows of pores along top of head over eyes, and along upper and lower jaws

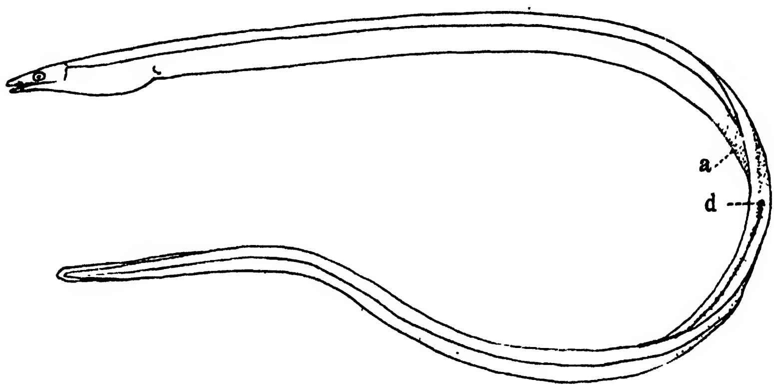

Fig. 1.—*Muraenichthys iredalei* Whitley *sp. nov.* Holotype, 163 mm. long, from Michaelmas Cay, Queensland. a. Origin of anal fin. d. Origin of dorsal fin.

Body very elongate. Dorsal originating as a rudimentary unpigmented area behind the vertical of the vent and extending to the tip of the tail where it joins the anal. Anal a little higher than dorsal, yet almost vestigial; like the dorsal it is situated in a groove. Lateral line running fairly high anteriorly, along the middle of the tail posteriorly. Tail one-thirteenth longer than trunk, almost rectangular in transverse section anteriorly.

Colour brownish, darker along the back, where there are innumerable blackish punctations. A fuscous area along each side of the thorax. The viscera show through blackish just behind the gill-slits. Fins without pigment.

Described and figured from the holotype, a spirit specimen, 163 mm. long; Australian Museum registered No. 1A.2743.

Locality.—Michaelmas Cay, off Cairns, Queensland, in sandy shallows of coral reef, 1st June, 1926. A smaller paratype, dredged with lancelets from the same locality, agrees with the holotype.

Named after Mr. Tom Iredale, of the Australian Museum, whom I accompanied on the collecting trip to Michaelmas Cay.

The new species belongs to that section of *Murænichthys* which has the dorsal originating behind the vertical of the vent. It differs mainly from *M. aoki* Jordan and Snyder[2] in its proportions, and from *M. tasmaniensis* McCulloch[3] in having uniserial vomerine teeth. *M. oliveri* Waite[4] has much smaller eyes.

Family OPHICHTHYIDÆ.

LEIURANUS SEMICINCTUS (*Lay and Bennett*).

Ophisurus semicinctus Lay and Bennett, Fishes in Zool. Beechey's Voyage, 1839, p. 66, Pl. xx, fig. 4. Oahu.

One specimen (1A.2742), Michaelmas Cay.

Family MURÆNIDÆ.

GYMNOTHORAX UNDULATUS (*Lacépède*).

Murænophis undulata Lacépède, Hist. Nat. Poiss., v, 1803, pp. 629 and 644, Pl. xix, fig. 2. No locality.

Muræna (Gymnothorax) undulata Weber and Beaufort, Fish. Indo-Austr. Archip., iii, 1916, p. 376.

One small specimen (1A.2739) from Michaelmas Cay.

GYMNOTHORAX CHILOSPILUS *Bleeker*.

Gymnothorax chilospilus Bleeker, Ned. Tijd. Dierk., ii, 1865, pp. 52 and 142. Sumatra, Amboina, Ceram and Buro. *Id.* Atl. Ichth., iv, 1865, p. 103, Pl. clxxxix, fig. 2.

Muræna (Gymnothorax) chilospilus Weber and Beaufort, Fish. Indo-Austr. Archip., iii, 1916, p. 379, fig. 188.

A specimen (1A.2740) from Michaelmas Cay, off Cairns, North Queensland. New record for Australia.

GYMNOTHORAX PICTUS (*Thunberg*).

Muræna picta Thunberg, De Muræna, 1789, p. 8 (*fide* Sherborn).

Muræna (Gymnothorax) picta Weber and Beaufort, Fish. Indo-Austr. Archip., iii, 1916, p. 363, figs. 175, 180, 182 and 183.

One specimen (1A.2741), Michaelmas Cay.

ECHIDNA NEBULOSA (*Thunberg*).

Muræna nebulosa Thunberg, De Muræna, 1789, p. 7 (*fide* Sherborn). *Id.* Day, Fish, India, i, 1878, p. 673, Pl. clxxii, fig. 2.

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[2] Jordan and Snyder.—Proc. U.S. Nat. Mus., xxiii, 1901, p. 863, fig. Misaki.

[3] McCulloch.—Zool. Res. "Endeavour," i, 1, 1911, p. 19, fig. 5. Oyster Bay, Tasmania.

[4] Waite.—Trans. N.Z. Inst., xlii, (1909), 1910, p. 374, Pl. xxxv, fig. 2. Kermadec Islands.

One specimen (1A.2697) from Michaelmas Cay, 27th May, 1926. Others in Australian Museum from Murray Island and Two Isles, North Queensland; Lord Howe Island; New Hebrides; Samoa; Batavia.

Leihala polyzona (*Richardson*).

Muræna polyzona Richardson, Ichth., Voy. "Sulphur," 1845, p. 112, Pl. lv, figs. 11-14. No locality .

Echidna polyzona McCulloch and Whitley, Mem. Qld. Mus., viii, 2, 1925, p. 135.

A twenty-inch specimen from Michaelmas Cay (1A 2694). Others in the Museum from Green Island, off Cairns, Queensland; Bougainville, Solomon Islands; Haapia, Friendly Islands; Duke of York Island and Malakula, New Hebrides.

The broad expanse of vomerine dentition admits this species into the genus *Leihala* recently proposed by E. K. Jordan[5].

Family SYNGNATHIDAE.

Doryrhamphus melanopleura (*Bleeker*).

Syngnathus melanopleura Bleeker, Nat. Tijd. Ned. Ind., xv, 1858, p. 464. Nova-selma.

Doryrhamphus melanopleura Weber and Beaufort, Fish. Indo-Austr. Archip., iv, 1922, p. 64, fig. 27. *Id.* Duncker and Mohr, Mitt. Zool. Mus. Hamburg, xli, 1925, p. 107.

One specimen (1A.2713), 46 mm. long, from Michaelmas Cay has the brood-pouch distended by eggs containing well developed embryos. It was caught on the outer coral reef, 27th May, 1926. Three others were collected by the late Allan R. McCulloch at Green Island, nearby.

Family BELONIDÆ.

Tylosurus terebra, *sp. nov.*

(Pl. i, fig. 6.)

D.ii/19; A.ii/22; P.i/11; V.i/5; C.13.

Depth (10 mm.) 24·3 in total length (243), head (89) 2·7 in same. Eye (7·5) equal to interorbital, 2 in postorbital portion of head (15). Upper jaw, from tip to anterior orbital rim (66) 2·9 times length of rest of head (23). Depth of caudal peduncle (4) 1·25 in its breadth (5). Length of pectoral (19) 4·6 in head.

[5] Jordan.—Proc. U.S. Nat. Mus., lxvi, 1925, p. 5. Orthotype, *Echidna leihala* Jenkins 1903.

Top of head with series of bony radiating ridges converging into a vertex behind each eye. A few radiating ridges over the operculum. Interorbital scaly where it is sunken between the ridges. Preoperculum, operculum, and occiput scaly. Eye large, just free of dorsal profile, with a flap over pupil. Maxillary elongate, concealed by preorbital when mouth is closed. Jaws elongate, the lower the longer, armed with many subvertical canines which tend to slant backward in the lower jaw. Sides and outer margins of jaws with many small thorn-like teeth. Median area of lower jaw with transverse ridges. Nostrils in large pyriform cavities. No gill rakers.

Body elongate, deeper than broad anteriorly, but considerably depressed on the keeled caudal peduncle. Scales cycloid. Lateral line continuous from breast to just behind anal fin as a series of slit scales running along lower part of body and asecnding slightly over ventral and anal fins; a branch extends up to each pectoral base. Vent somewhat in advance of the anal.

Anal originating noticeably in advance of dorsal and terminating behind it. The anterior rays of both fins form lobes, and their posterior rays do not reach the caudal. Pectorals pointed. Ventrals entirely inferior, shorter than pectorals; their origin nearer anterior border of eye than base of caudal. Caudal emarginate, the lower lobes apparently the longer.

Colour.—In life the general colour was sea-green with intense silvery iridescence, especially on the sides and lower surfaces. Three greyish longitudinal lines on back, the middle one thickest. Purplish iridescence below preorbital and in the green on the top of the head when the fish was turned in the light. Fins greenish, the caudal with an indefinite dusky area on the distal half of the upper lobe. A bluish line along the sides, which turned bright silver in certain lights. Axil of pectoral dark green.

After preservation in alcohol, the colour is yellowish-brown, darker above, with three dark lines along the back. Lateral streak silvery green. A dark spot on upper part of preopercular border, and a dark blotch on caudal. Caudal keel silvery, not black

Described and figured from the unique holotype, 243 mm. in total length, from Michaelmas Cay, Great Barrier Reef, off Cairns, Queensland; collected by T. Iredale and G. P. Whitley, 7th June, 1926. The specimen was swimming at the surface inshore at night, and was netted by lamp-light. Austr. Mus. regd. No. 1A.2736.

The specific name is given in allusion to the drillers, Messrs. Eric H. and Donald Duffield, T. Hughes and M. T. Bloomer, of Melbourne, who, with Mr. Charles Horridge, the cook, spent much of their leisure in helping Mr. Iredale and myself to secure specimens.

Family EXOCŒTIDÆ.

PAREXOCŒTUS BRACHYPTERUS (*Richardson*).

Exocœtus brachypterus Richardson, Rept. 15th Meet. Brit. Assoc. Adv. Sci., (1845) [Sept.-Oct.] 1846, p. 265. Based on Parkinson's figure No. 108 of *E. brachypterus* Solander MS. from Tahiti.

Exocœtus mento Cuvier and Valenciennes, Hist. Nat. Poiss., xix, "1846" = May, 1847, ed. 1, p. 124; ed. 2, p. 90. Pondicherry.

Exocœtus solandri Cuvier and Valenciennes, *op. cit,* ed. 2, p. 94. *Ex* "[*Exocœtus*] *brachiopterus*" Solander MS. Tahiti.

Parexocœtus mento Bleeker, Atl. Ichth., vi, 1866, p. 77, Pl. ccli, fig: 6. *Id.* Barnard, Ann. S. Afr. Mus., xxi, 1925, p. 267.

Exocœtus atrodorsalis Günther, Ann. Mag. Nat. Hist., (3), xx, 1867, p. 67. Cape York.

Exocœtus gryllus Klunzinger, Verh. Zool. Bot. Ges. Wien, 1871, p. 585. Red Sea. *Fide* Günther, Zool. Rec., (1871) 1873, p. 109.

Parexocœtus brachypterus Weber and Beaufort, Fish. Indo-Austr. Archip., iv, 1922, p. 174, fig. 60.

Seven specimens were washed ashore in a more or less mutilated condition at Michaelmas Cay. The species was occasionally seen flying over the reefs in the lagoon.

Exocœtus brachypterus vs. *mento.* Both names appeared to have been published in the same year, 1846, so I wrote to Mr. C. Davies Sherborn for more precise dates. He courteously replied (*in. lit.*, 5th September, 1926) : "Exocœtus brachypterus Richardson, 15 Rept. Brit. Assoc. We have no knowledge of exact dates of these repts. But usually the vol. appears the following Sept. or Oct." Mr. Sherborn has given the date of the nineteenth volume of the *Histoire Naturelle des Poissons* as May, 1847[6].

Family HEMIRAMPHIDÆ.

HEMIRAMPHUS (HYPORHAMPHUS) DUSSUMIERI

Cuvier and Valenciennes.

Hemiramphus dussumieri Cuvier and Valenciennes, Hist. Nat. Poiss., xix, 1847, p. 33 (*fide* Sherborn) ; ed. 2, p. 24. Seychelles.

Hemirhamphus dussumieri Weber and Beaufort, Fish. Indo-Austr. Archip., iv, 1922, p. 155.

Three fine specimens (IA.2733-2735) preserved from Michaelmas Cay. Very common at surface inshore, especially at night. The species has not hitherto been recorded from Australia.

[6] Sherborn.—Ann. Mag. Nat. Hist., (9), xv, 1925, p. 600.

Family ATHERINIDÆ.

Hepsetia lacunosa (*Bloch and Schneider*).

Atherina lacunosa Bloch and Schneider, Syst. Ichth., 1801, p. 112. *Ex* Forster MS. New Caledonia. *Id.* Ogilby, Mem. Qld. Mus., i, 1912, p. 40, Pl. xii, fig. 2, and text-fig. b.

Hepsetia lacunosa Jordan and Hubbs, Monogr. Atherinidæ, 1919, p. 33.

Six specimens (1A.2805-7) were collected from those washed ashore, one or two at intervals, at Michaelmas Cay in May-June, 1926.

Family MUGILIDÆ.

Mugil crenilabis *Bonnaterre.*

Mugil crenilabis Forskal, Descr. Anim., 1775, p. 73. Non-binomial work. Red Sea. *Id.* Bonnaterre, Tabl. Encycl. Meth., Ichth., 1788, p. 180. *Ex* Forskal. *Id.* Weber and Beaufort, Fish. Indo-Austr. Archip., iv, 1922, p. 256.

Mugil cirrhostomus Bloch and Schneider, Syst. Ichth., 1801, p. 121. *Ex* J. R. Forster MS. Pacific Ocean.

Mugil crenilabris Günther, Fische Südsee, vii, 1881, p. 219, Pl. cxxii, fig. a.

Life Colours.—Head, body, and tail greyish-green with a frosty silvery tint, especially noticeable on sides and ventral surface. Fins plain; pectorals yellowish with a bluish-black axillary mark extending along first ray.

Three specimens showed the following variation: D.iv/9-10; A.iii/9-10; L. lat. 39-40 to hypural; l. tr. from origin of first dorsal 13-13½.

Seen in schools on windward side of islet at night, usually swimming sluggishly along bottom, when they could be netted by hand by lamp-light, or, when disturbed, skimming along near surface, often making splendid leaps.

Locality.—Michaelmas Cay, off Cairns, Queensland, a seventeen-inch specimen preserved (1A.2693). A small specimen in Australian Museum from Santo, New Hebrides. The record of this species from "Southern Queensland" by Ogilby[7] has been hitherto overlooked.

Family HOLOCENTRIDÆ.

Holocentrus spinifer (*Bonnaterre*).

Sciæna spinifera Forskal, Descr. Anim., 1775, p. 49. Work non-binomial. Djedda, Red Sea. *Id.* Bonnaterre, Tabl. Encycl. Meth., Ichth., 1788, p. 120. *Ex* Forskal.

[7] Ogilby.—Ann. Rept. Amat. Fisherm. Assoc. Qld., (1905-6) 1906, p. 9.

Holocentrus spinifer Rüppell, Neue Wirbelth., Fische, 1838, p. 97, Pl. xxv, fig. 1.

Colour.—General colour pinkish-red, lighter below; each scale with a silvery centre. A few violet dots along junctions of some lateral scale-rows. Cheek-scales with a bronze sheen. Pupil black, surrounded by a golden ring, rest of eye pinkish-brown. A gout of crimson on upper half of preoperculum, another in pectoral axil, and a third on the inner proximal half of the pectoral fin. Whole of first dorsal vivid scarlet, other fins yellow.

Specimen caught at Michaelmas Cay, 21st May, 1926; length 283 mm. to end of middle caudal rays; head preserved. Regd. No. 1A.2814.

The species has not hitherto been recorded from Australia.

Family SOLEIDÆ.

PARDACHIRUS PAVONINUS (*Lacépède*).

Achirus pavoninus Lacépède, Hist. Nat. Poiss., iv, 1802, pp. 658 and 660. No locality = Dutch East Indies (*fide* Ogilby).

Pardachirus pavoninus Ogilby, Mem. Qld. Mus., v, 1916, p. 142, Pl. xvi. *Id.* Norman, Biol. Res. "Endeavour," v. 5, 1926, p. 288.

Two specimens (1A.2706 and 2945), in sandy shallows, Michaelmas Cay.

SOLEICHTHYS HETERORHINOS (*Bleeker*).

Solea heterorhinos Bleeker, Act. Soc. Sci. Indo-Neerl., i, 1856, p. 64. Amboina.

Solea (*Solea*) *heterorhinus* Bleeker, Atl. Ichth., v, 1865, p. 17, Pl. ccxl, fig. 2.

One specimen (1A.2948), Michaelmas Cay.

Family EPINEPHELIDÆ.

EPINEPHELUS MERRA *Bloch.*

(Pl. i, fig. 4.)

Epinephelus merra Bloch. Nat. Ausl. Fische, vii, 1793, p. 17 (*fide* Sherborn). *Id.* Bloch, Ichtyologie, x, 1797, p. 15, Pl. cccxxix. Sea of Japan.

Common at Michaelmas Cay. I have also collected this species at North-West Islet, Capricorn Group, Queensland.

A young specimen (1A.2715) from Michaelmas Cay, 46 mm. long, is here figured to show the disposition of the colour-markings at this stage.

EPINEPHELUS SUMMANA (*Bonnaterre*).

Perca summana Forskal, Descr. Anim., 1775, p. 42. Work non-binomial. Red Sea. *Id.* Bonnaterre, Tabl. Encycl. Meth., Ichth., 1788, p. 132. *Ex* Forskal.

Epinephelus summana Boulenger, Cat. Fish. Brit. Mus., (2) i, 1895, p. 248.

One from Michaelmas Cay (1A.2960). New record for Australia.

Life Colours.—General colour pale green with brown wavy or reticulating markings becoming broken up in places or congealed to form irregular bars; better marked on dorsal, anal, and caudal fins, where they enclose roundish green spots. The edges of those fins are white with a broad inframarginal band of dark brown, almost black. Head with no definite markings, the brown and the pale green being clouded. Pectorals and ventrals lighter marked than other fins, their spots obscure. Pupil dark brown, surrounded by golden ring; rest of eye dusky brown on golden yellow ground. The colours are well shown in Bleeker's figure[8].

D.xi/16; A.iii/9; head 102 mm., length 289.

Family PSEUDOCHROMIDÆ.

PSEUDOCHROMIS FUSCUS *Müller and Troschel.*

Pseudochromis fuscus Müller and Troschel, Horæ Ichthyologicæ, iii, 1849, p. 23, Pl. iv, fig. 2 (*fide* Günther). Celebes. *Id.* McCulloch, Biol. Res. "Endeavour," v, 4, 1926, p. 186 (references and synonymy).

One specimen (1A.2745), Michaelmas Cay, coral reef. The following is a copy of the original description of *P. fuscus,* kindly forwarded by the Chief Librarian, Public Library, Melbourne.

PSEUDOCHROMIS FUSCUS *Nob. nov. sp.*

(Taf. iv, fig. 2.)

Der Kopf ist 4 mal in der ganzen Länge des Fisches enthalten. Der Unterkiefer ist etwas länger als der Oberkiefer. Die Entfernung der Augen von der Schnauzenspitze ist etwas kleiner als der Durchmesser eines Auges, die Entfernung beider Augen von einander ist etwas kleiner als der Durchmesser eines Auges. Das hintere Nasloch steht dem Auge sehr nah. Der obere Theil des hinteren Randes der Kiemendeckels trägt einige äusserst kleine Spitzchen. Die Rückenflosse beginnt gerade über der Insertion der Brustflossen. Hinter den drei Stacheln der Rückenflosse, welche nach hinten an Länge zunehmen, folgen fünfzehn einfache gegliederte, und auf diese wieder noch eilf verzweigte Strahlen. Die Rückenflosse hört dicht von der Schwanzflosse auf, und ihre hintere Spitze reicht bis auf den Anfang der Schwanzflosse; dasselbe gilt von der Afterflosse. Die Schwanzflosse ist abgerundet. Die Seitenlinie steigt Anfangs in die Höhe und nähert sich der

[8] Bleeker.—Atl. Ichth. vii, 1870, Pl. cclxxxii, fig. 2, as *E. bataviensis.*

Basis der Rückenflosse, mit der sie parallel verläuft, bis sie abbricht. Die untere Seitenlinie befindet sich von da an in der Mitte des Körpers, und ist aus neun Schuppen gebildet.

B.6. D.3.15.11. A.3.14. P.18. V.1.5.

Farbe: gleichmässig braun.

Grösse: 2¼ Zoll.

Vaterland: Celebes, durch Schönlein.

Pseudochromis (Leptochromis) tapeinosoma *Bleeker*.

Pseudochromis tapeinosoma Bleeker, Nat. Tijd. Ned. Ind., iv, 1853, p. 115. Amboina.

Pseudochromis (*Leptochromis*) *tapcinosoma* McCulloch, Biol. Res. "Endeavour," v. 4, 1926, p. 192, Pl. li, figs. 1-2.

Three males (1A.2746) from Michaelmas Cay, coral reef.

Family PLESIOPIDÆ.

Pharopteryx melas (*Bleeker*).

Plesiops melas Bleeker, Verh. Batav. Gen., xxii, 1849, p. 9. Bali.

Pharopteryx melas Jordan and Seale, Bull. U.S. Fish. Bur., xxv, 1906, p. 261, Pl. xxxviii, fig. 3. *Id.* Ogilby, Mem. Qld. Mus., ii, 1913, p. 84.

Life Colours.—Head, body, and tail olive-brown; some yellow on the branchiostegal membranes which are violet at the isthmus, and some yellow interorbital speckles. Eye golden, rimmed with violet. In some specimens there are a few vertical brownish bars and white spots on the sides of the head. Dorsal rich brown, the tips of the rays orange, followed by a whitish stripe; lower part of fin crossed by one or two oblique violet-blue stripes. Anal reddish-brown with a blue sub-horizontal stripe. Pectorals greyish; ventrals greyish, densely speckled with brown. Eleven dorsal spines.

Locality.—Michaelmas Cay, off Cairns, Queensland; four specimens (1A.2749-2752).

The Australian and Papuan species of *Pharopteryx* appear to be distinguishable as follows:—

A. Dorsal with twelve spines.

B. Dorsal and anal almost reaching vertical of middle of caudal. Head 4 in total length .. .. *woodlarkensis*[9].

BB. Dorsal and anal terminating well before vertical of middle of caudal. Head about 3¾ in total length .. .. *nigricans*[10].

AA. Dorsal with eleven spines (abnormally ten, *fide* Ogilby) .. *melas*.

[9] Thiollière.—Ichthyologie, in Montrouzier, Essai sur la Faune de l'Ile de Woodlark ou Moiou, 1856, p. 160 (*Plesiops*). Woodlark Island. Reprint from Ann. Soc. imp. d'agric., &c., Lyon, viii, 1856.

[10] Rüppell.—Atl. Reise Nordl. Afrika, 1828, p. 15, Pl. iv, fig. 2 (*Pharopterix* on plate). Mohila, Red Sea.

Family APOGONIDÆ.

Apogon savayensis *Günther.*

Apogon savayensis Günther, Proc. Zool. Soc. Lond., 1871, p. 656. Savay (Samoa). *Id.* Günther, Fische Südsee, i, 1873, p. 21, Pl. xix, fig. b. *Id.* Day, Fish. India, i, 1878, p. 60, Pl. xvi, fig. 5. *Id.* McCulloch, Proc. Linn. Soc. N.S. Wales, xlvi, 4, 1921, p. 469.

Amia savayensis Jordan and Seale, Bull. U.S. Fish. Comm., xxv, 1906, p. 239, fig. 33.

Life Colours.—Body colour olive-greenish, almost crossed by five subvertical silvery streaks beneath the dorsal fins. A saddle-shaped smoky blotch over the caudal peduncle and crossing the lateral line, and an oblique black streak below and behind the eye, which is dull blue with a black pupil. Dorsal and anal yellowish; spinous dorsal with a dusky mark on distal half. Pectorals pinkish, ventrals whitish; rays of caudal olive, their membranes hyaline.

Eight specimens (1A.2757) were caught by removing masses of a yellowish-green staghorn coral (*Acropora hebes* Dana) from the water; the species was not found in any other kind of coral at Michaelmas Cay.

Fowleria aurita (*Cuvier and Valenciennes*).

Apogon auritus Cuvier and Valenciennes, Hist. Nat. Poiss., vii, 1831, p. 443. Mauritius.

Apogonichthys polystigma Bleeker, Atl. Ichth., viii, 1875, Pl. cccxxii, fig. 4.

Amia polystigma Bleeker, *Op. cit.*, vii, 1876, p. 101.

One (1A.2755), Michaelmas Cay.

Nectamia fusca (*Quoy and Gaimard*).

Apogon fuscus Quoy and Gaimard, Voy. "Uranie," Zool., 1825, p. 345. Guam.

Amia fusca Jordan and Seale, Bull. U.S. Fish. Bur., xxv, 1906, p. 244, fig. 38.

Nectamia fusca Jordan, Copeia No. 44, 1917, p. 47.

A specimen (1A.2756), 40 mm. long, from Michaelmas Cay, agrees well with the descriptions and figure quoted above, but lacks the dark mark on the tail. The species has not hitherto been recorded from Australia.

CHEILODIPTERUS QUINQUELINEATUS *Cuvier and Valenciennes.*

Cheilodipterus quinquelineatus Cuvier and Valenciennes, Hist. Nat. Poiss., ii, 1828, p. 167. Bola-Bola, Society Islands. *Id.* Castelnau, Res. Fish. Austr. (Vict. Offic. Rec. Philad. Exhib.), 1875, p. 9.

Paramia quinquelineata Bleeker, Atl. Ichth., vii, 1875-6, p. 105, Pl. cccxxvi, fig. 2.

The Australian Museum has one small specimen from Michaelmas Cay, and several from Murray, Hayman, and Holbourne Islands, Queensland.

Family CARANGIDÆ.

TRACHINOTUS BAILLONII (*Lacépède*).

Cæsiomorus baillonii Lacépède, Hist. Nat. Poiss., iii, 1802, p. 92, Pl. iii, fig. 1. No locality = Fort Dauphin, Madagascar (*fide* Cuv. and Val.).

Trachinotus bailloni Ogilby, Mem. Qld. Mus., v, 1916, p. 149, Pl. xviii.

Four specimens (1A.2698, 2702) from Michaelmas Cay, where the species was very common in the shallow water inshore. Small specimens swam in the wavelets which lapped the beach, but, by the alacrity of their movements, always managed to avoid being washed ashore. At night they could be caught in a hand-net by lamp-light.

TRACHINOTUS OVATUS (*Linnæus*).

Gasterosteus ovatus Linnæus, Syst. Nat., ed. 10, 1758, p. 296. Asia.

Trachinotus ovatus Ogilby, Rept. Mar. Dept. Qld., (1908-9) 1909. Append. v, p. 19, and Mem. Qld. Mus., v, 1916, p. 154, Pl. xix.

One small specimen (1A.2703) caught with *T. baillonii* at night, Michaelmas Cay.

Family EMMELICHTHYIDÆ.

EMMELICHTHYS NITIDUS *Richardson.*

Emmelichthys nitidus Richardson, Ichth. Voy. "Erebus" and "Terror," 1845, p. 47, Pl. xxix, figs. 7-8. West Australia.

One specimen of this rare fish (1A.2797) was washed ashore dead at Michaelmas Cay on 22nd May, 1926. New record for Queensland.

Colours.—Lavender on back crossed by three broad longitudinal bands, lower parts of body silvery. Dorsal fin-rays pink, the

membranes hyaline; anal and ventrals white, caudal pink, pectoral white with a small dark basal blotch.

Family LUTJANIDÆ.

LUTJANUS *sp. juv.*

(Pl. i, fig. 2.)

A specimen, 34 mm. long, from Michaelmas Cay (1A.2808), figured here, has the following characters: D.x/14; A.iii/8; C.17 (15 branched); L. lat. 51.

First dorsal spine short. Scales ctenoid; an enlarged one in ventral axil. Sides of head and body scaly. Maxillaries, mandible and interorbital region naked. Seven rows of scales between origin of spinous dorsal and lateral line. Preoperculum serrated, one very large and several strong spines at angle. Strong teeth in jaws, on vomer and palatines; none on tongue.

[LUTJANUS RUSSELLII (*Bleeker*).

Mesoprion russellii Bleeker, Verh. Bat. Gen., xxii, 1849, Perc., p. 41. Malayo-Moluccan Archipelago.

Lutjanus russellii Bleeker, Atl. Ichth., viii, 1876, p. 71, Pl. ccc, fig. 2.

One specimen from Cairns (1A.2796); a coastal species not met with at Michaelmas Cay. The Museum also has specimens from Port Darwin and Pellew Group, Northern Territory; Murray Island and Moreton Bay, Queensland; and Richmond River, New South Wales. Another, purchased from Dr. F. Day, came from Akyab.]

Family POMACENTRIDÆ.

POMACENTRUS WARDI *Whitley.*

Pomacentrus trilineatus Bleeker, Atl. Ichth., ix, 1877, Pl. ccccvi, figs. 1-6. (East Indies.) *Non* Cuvier and Valenciennes, 1830.

Pomacentrus wardi Whitley, Rec. Austr. Mus., xv, 5, 1927, p. 301, fig. 1. Heron Island, Great Barrier Reef, Queensland.

One small specimen from Michaelmas Cay (1A.2776). Surgeon-Lieutenant L. Lockwood, R.A.N., has recently collected specimens from Whitsunday Passage and South Percy Island, Queensland.

Variation.—Typical specimens of *P. wardi* have the following characters: D.xiii/15 (sometimes 16, rarely 14); A.ii/15 (rarely 16). 17-19 tube-bearing scales. Males very dark brown with dark pectorals and yellowish or brownish tails, usually with a few whitish flecks on the snout. Females lighter brown, most of the scales with a fuscous pencilled crescent; dorsal sometimes lighter

than anal and ventrals. Opercular and axillary dots present or absent. Young specimens are lighter than adults, with or without a white-edged black ocellus on the distal half of the soft dorsal. and with many whitish flecks on body-scales, head, and fins. The caudal in the young may be fuscous or yellowish.

A specimen from Cape Wessel, Northern Territory (1A 1700) has fourteen dorsal spines and rays, but is distinguished in no other characters from the Queensland forms mentioned above.

Another specimen from "German New Guinea" [= Mandated Territory of New Guinea] agrees with Bleeker's fig. 2, having a much flecked body, prominent opercular spot, and a large ocellus on the proximal half of the dorsal fin.

Pomacentrus wardi has been recorded from Port Darwin, Northern Territory, and Port Denison, Queensland, by Klunzinger[11].

Of Bleeker's figures, 1 and 2 are identical with my New Guinea form, 4 and 5 resemble Queensland females, whilst I have seen no specimens corresponding to 3 and 6, which, however, appear to come well within the limits of the variation of this species.

POMACENTRUS SUFFLAVUS *sp. nov.*

(Pl. i, fig. 3.)

D.xiii/15; A.ii/15; P.17; V.i/5; C.15. Sc. 26 to hypural; 17 tube-bearing scales on l. lat.

Depth, including scaly sheath of dorsal (14 mm.), 2 in length to hypural joint (28). Head (9) 3·1 in the same. Interorbital (3) and snout (2·5) smaller than eye (4).

Upper part of head flattened between the eyes, which are large. Preorbital distinct from suborbital. Preoperculum serrated, other opercles entire. Head scaly except around nostrils and lips and along the suborbital, which is incipiently serrated and bears a row of pores. About sixteen predorsal scales. Teeth sharp, compressed.

Body deep, compressed and covered with scales which extend on to all the fins except the ventrals, which, however, have axillary scales. Lateral line ascending in an even curve with seventeen tubes. followed on the sides of the tail by a number of irregularly disposed pierced scales.

Soft dorsal and anal pointed; first ventral ray filiform, reaching beyond vent when adpressed. Pectorals rounded. Caudal emarginate, with rounded lobes.

Colour in spirits brownish-yellow, the fins lighter. Some whitish flecks along the cheeks below the suborbitals and others on the

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11 Klunzinger.—Sitzb. Akad. Wiss. Wien, lxxx, 1, 1879, p. 376 (*recte* 396 = p. 72 of reprint), as *P. trilineatus*.

opercles. A series of similar white marks forms a descending white band along a scale-row on the lower part of the side, and is continued as an inframarginal band along the soft anal fin. The anal spines and the tips of the anterior rays are fuscous. The vent and an axillary spot on the pectoral are blackish.

Described and figured from the holotype, 28 mm. in length from snout to hypural joint, from Michaelmas Cay, off Cairns, North Queensland; collected by T. Iredale and G. P. Whitley in May, 1926. It is the larger of two specimens obtained at the same time. Australian Museum registered No. 1A.2777.

Besides the holotype, there is a series of twelve specimens, 31-75 mm. long, in the Australian Museum. These show that the dark anal border, axillary spot on the pectoral, and black vent are constant. Specimens a little larger than the holotype have a blue opercular spot in addition. The white flecks on the head and sides become more boldly marked with age, whilst some specimens have upright whitish marks on the body-scales.

The colours of a specimen from Holbourne Island, Queensland, were noted as follows:—"General colour after preservation in weak spirit, canary yellow. The top of the head, nape, and greater part of sides more or less tinged with olive. A streak of pale pink from the eye to the upper lip; a series of similarly coloured dots from the corner of the mouth around the eye to the upper limb of the preoperculum and some large similar spots on the operculum. A pale blue spot at the commencement of the lateral line and a black one in the axil. Fins yellow like the body, the anterior portion of the dorsal olive, and a broad, darker, olive margin at the anterior portion of the anal." The pink markings become milky-white in alcohol.

Larger specimens have the suborbital strongly denticulated and separated from the preorbital by a notch, and have the preoperculum markedly more serrated than the young.

Localities.—Queensland, Barrier Reef, one specimen; Holbourne Island, Hayman Island reef, and Whitsunday Passage (E. H. Rainford), nine specimens; North-west Islet, Capricorn Group (G. P. Whitley), one specimen; Michaelmas Cay (T. Iredale and G. P. Whitley), holotype and paratype.

Habitat.—Amongst coral, Great Barrier Reef, Queensland.

POMACENTRUS ALBIFASCIATUS *Schlegel and Müller.*

Pomacentrus albifasciatus Schlegel and Müller, Verh. Nat. Ges. Ned. overz. bezitt. (Zool.), Pisces, 1844, p. 21. Celebes.

Eupomacentrus albofasciatus Bleeker, Atl. Ichth., ix, 1877, Pl. cccciii, fig. 6.

One from Michaelmas Cay has D.xii/16; A.ii/13.

New record for Australia.

Pomacentrus chrysurus *Cuvier and Valenciennes.*

Pomacentrus chrysurus Cuvier and Valenciennes, Hist. Nat. Poiss., v, 1830, p. 423. (*Ex Chætodon chrysurus* Broussonet MS.) La Mer du Sud. *Id.* Günther, Cat. Fish. Brit. Mus., iv, 1862, p. 29. *Id.* Jordan and Seale, Bull. U.S. Fish. Bur., xxv, 1906, p. 281. *Id.* Whitley, Austr. Zool., iv, 4, 1926, p. 230.

Eleven from Michaelmas Cay. A post-larval specimen has a large white-edged dorsal ocellus. This appears to recede posteriorly with age.

Glyphisodon hedleyi *sp. nov.*

(Pl. i, fig. 5.)

D.xiii/12; A.ii/13; P.17; V.i/5; C.15. L. lat. 17. L. tr. 3/1/9½.

Head (15 mm.) 3·5 in the length to the hypural joint (53); depth (22·5) 2·3 in the same. Eye (5) 3, interorbital (4·5) 3·3, snout (3·3) 4·5, and depth of caudal peduncle (8) 1·9, in the head.

Upper profile of head convex, steeper than the lower. Head scaly except for an area in front of the eyes and around the mouth, the superior scales terminating on the convex interorbital. Many of the scales on each side of the nape and a few on the top of the head are punctured by pores. A series of minute circular pores passes around the hinder margin of the orbit and another skirts the preorbital; there are also scattered pores on various parts of the head. Eye large, its diameter slightly longer than the interorbital width. Nostrils a simple opening on each side of the snout. Preorbital and all the opercles entire; two small opercular spines, well separated. Maxillary reaching vertical of anterior margin of eye. Teeth blunt, compressed, in a single series in each jaw. Gill-rakers long, slender, close-set.

Body compressed, entirely covered with well-developed ctenoid scales which extend on to parts of all the fins except the ventrals. The scales are largest and most regular on the sides, in about twenty-six transverse series, but become smaller as they encroach upon the fins. Along the dorsal and anal bases the marginal scales are somewhat acuminate. The lateral line extends to below the end of the first dorsal and consists of seventeen tube-bearing scales. About six punctured scales extend along each side of the caudal peduncle and a few more are asymmetrically disposed between them and the tubiferous ones. About thirteen predorsal scales. Ventral surface between anal and ventral fins carinate; the anus is in a slit before the anal spines. A small genital papilla.

Dorsal arising slightly behind the vertical of the ventral spines and terminating a trifle behind the vertical of the base of the last anal ray. The soft dorsal is somewhat pointed and is higher than the spinous. Membrane of first dorsal produced into pennant-like

flaps, with a deep incision behind each. Anal similar to dorsal, originating below the centre of the fish; the first ray is simple, the rest branched. Pectoral rounded, a little shorter than head. Ventrals long and angular, extending to anal spines. Caudal lobes much rounded, the lower more so than the upper.

Colour.—The collector noted the colours as "brilliant blue in life, tail orange-red; and ocelli on the head." After preservation in spirits, the body and unpaired fins are uniformly blue, with the exception of the scaleless portion of the caudal, which is yellowish with a narrow black margin. Many of the scales on the sides have one or two minute blue-edged ocelli at their angles. The outer half of some of the scales had a burnished tinge. An irregular dark blue bar crosses the snout, passes through the eye and resolves itself into a series of blue blotches on the scales immediately over the lateral line. A similar series of blotches, which may have been the "ocelli on the head" noted in the live specimen, extends from above the eye to the second row of scales below the first dorsal. Other dark-blotched scales on the opercle, lower part of preopercle, and in irregular series on the sides just above the pectoral. A brownish bar along base of pectoral, but no axillary blotch or spot. Fins uniform with no ocelli; pectorals yellowish, ventrals light bluish.

Described and figured from the holotype, 53 mm. in length to the hypural joint. It was collected at Dauco Island Reef, off Port Moresby, Papua, by the late Allan R. McCulloch, Austr. Mus. regd. No. 1A.1328.

Mr. McCulloch also collected a paratype at St. Crispin Reef, off Port Douglas, Queensland. I collected a young specimen at North-West Islet, Queensland.

Another paratype from Michaelmas Cay, Queensland, agrees with the Papuan specimen, but has the soft dorsal and anal produced into pointed lobes.

Affinities.—*Glyphisodon hedleyi* is related to *G. uniocellatus* Quoy and Gaimard, but lacks the light ventral colouring and the prominent dark blotch near the end of the soft dorsal which is a regular characteristic of that species.

I name this novelty in honour of the late Charles Hedley, F.L.S., who directed the boring operations of the Great Barrier Reef Investigation Committee at Michaelmas Cay.

Range.—Queensland and Papua.

GLYPHISODON (PARAGLYPHIDODON) MELAS *Cuvier and Valenciennes.*

Glyphisodon melas Cuvier and Valenciennes, Hist. Nat. Poiss., v, 1830, p. 472. *Ex* Kuhl and Van Hasselt MS. Java. *Id.* Schlegel and Müller, Verh. Nat. Ges. Ned. overz. bezitt., Zool. (Pisces), 1844, p. 23, Pl. v, fig. 2.

Glyphisodon ater Cuvier and Valenciennes, Hist. Nat. Poiss., v, 1830, p. 473. *Ex* Ehrenberg MS. Massowah, Red Sea.

Glyphidodon melas Günther, Cat. Fish. Brit. Mus., iv, 1862, p. 45.

Paraglyphidodon melas Bleeker, Atl. Ichth., ix, 1877, Pl ccccliv, fig. 4.

A fine specimen (1A.2758) from Michaelmas Cay. In life it was uniformly black except for the pectorals, which were tinged with bottle-green. The species has not hitherto been recorded from Australia.

GLYPHISODON MODESTUS *Schlegel and Müller.*

Glyphisodon modestus Schlegel and Müller, Verh. Nat. Ges. Ned. overz. bezitt., Zool. (Pisc.), 1844, p. 23, Pl. vi, fig. 2. Java.

Glijphisodon phaiosoma Bleeker, Verh. Bat. Genootsch., xxii, 1849, p. 9. Bali.

Glyphidodon modestus and *phaiosoma* Günther, Cat. Fish. Brit. Mus., iv, 1862, p. 55.

Glyphisodontops modestus Bleeker, Atl. Ichth., ix, 1877, Pl. ccceiii, fig. 9.

With the assistance of Calisch's Dictionary[12], I have made the following translation of the original description of this species.

Body oblong, unicoloured, without spots.

Glyphisodon modestus n. sp. Drawn from life at Java by Maurevert. Colour very pale; body white; dirty pale citron-yellow on the back. Fins of the same colour, but paler. Dorsal, caudal and anal pale bluish towards their margins. A pale red stripe along the upper margin of the dorsal fin Length 3 to 4 inches. D.13 + 12; A.2 + 12. Caudal slightly emarginate. Collected by Kuhl and van Hasselt in the Java Sea, from the north coast of Java and the south coast of Borneo; also on the west coast of Sumatra.

One specimen, 90 mm. in total length, from Michaelmas Cay, allows the addition of this species to the Australian fauna. Regd. No. 1A.2778.

D.xiii/13; A.ii/13. 16(?) tube-bearing scales (some missing). L. tr. 11.

Head 4, height 3 in total length. Preorbital 2 in eye. Suborbital and opercles entire. Caudal lobes and soft dorsal and anal rounded. First ventral ray filiform, reaching vent. Brownish on head, body, and fins. Pectorals yellowish. No axillary spot. The Michaelmas Cay specimen agrees better with Bleeker's figure than with Schlegel and Müller's.

[12] Calisch.—Nederlandsch-Engelsch Wordenboek, 1875.

GLYPHISODON ZONATUS *Cuvier and Valenciennes.*

Glyphisodon zonatus Cuvier and Valenciennes, Hist. Nat. Poiss., v, 1830, p. 483. New Guinea. *Id.* Whitley, Austr. Zool., iv, 4, 1926, p. 230, Pl. xxxiv.

One small specimen (1A.2779) from Michaelmas Cay.

TETRADRACHMUM *Cantor.*

Dascyllus Cuvier, Règne Anim., ed. 2, ii, 1829, p. 179. Orthotype, *Chætodon aruanus* Linnæus. Preoccupied by *Dascillus* Latreille 1796, a genus of Coleoptera, sometimes written *Dascyllus.*

Pirene Gistel, Naturg, Thierr. hohere Schulen, 1848, p. ix. New name for *Dascyllus* Cuvier and Valenciennes 1830 (= Cuvier 1829), not Latreille 1797 (= 1796). Preoccupied by *Pyrene* Bolten 1798, a genus of Mollusca.

Tetradrachmum Cantor, Journ. Asiatic Soc. Bengal, xviii, 2, Nov.-Dec. (?), 1849, p. 1222. *Id.* Cat. Malay. Fish., 1850, p. 240. New name for *Dascyllus* Cuvier 1829, preoccupied.

Since *Pirene* Gistel is preoccupied in Mollusca, the next name, *Tetradrachmum* Cantor, must be used for *Dascyllus* Cuvier (*non* Latreille).

Cantor's name was first published in the November, 1849, number of the Journal of the Asiatic Society of Bengal, but may not have appeared until December, 1849, or even later. The Catalogue of Malayan Fishes was probably printed late in 1850, as the Australian Museum copy is inscribed "Tho. Horsfield. From the author, Feb. 21st, 1851."

TETRADRACHMUM ARUANUM (*Linnæus*).

Chætodon aruanus Linnæus, Syst. Nat., ed. 10, 1758, p. 275, and ed. 12, 1766, p. 464. "Indiis" = Aru Islands. *Id.* Bloch, Ichtyologie, vi, 1788, Pl. cxcviii, fig. 2.

Dascyllus aruanus Cuvier and Valenciennes, Hist. Nat. Poiss., v, 1830, p. 434.

Sixteen specimens (1A.2759) from Michaelmas Cay agree with Cuvier and Valenciennes's description of the disposition of the colour markings.

TETRADRACHMUM XANTHOSOMA (*Bleeker*).

Dascyllus xanthosoma Bleeker, Nat. Tijd. Ned. Ind., ii, 1851, p. 247. Banda. *Id.* Günther, Cat. Fish. Brit. Mus., iv, 1862, p. 14; and Fische Südsee, vii, 1881, p. 237, Pl. cxxiv, fig. C.

One from Michaelmas Cay (1A.2763) and three from the New Hebrides (I.13910-12) are in the Australian Museum. New record for Australia.

ACANTHOCHROMIS LONGICAUDIS (*Alleyne and Macleay*).

Heptadecanthus longicaudis Alleyne and Macleay, Proc. Linn. Soc. N.S. Wales, i, 1877, p. 343, Pl. xv, fig. 3. Cape Grenville, Queensland.

Acanthochromis longicaudus McCulloch and Whitley, Mem. Qld. Mus., viii, 2, 1925, p. 166.

One (1A.2762) from Michaelmas Cay.

CHROMIS LEPISURUS (*Cuvier and Valenciennes*).

(Pl. i, fig. 1.)

Heliases lepisurus Cuvier and Valenciennes, Hist. Nat. Poiss., v, 1830, p. 498. New Guinea.

Chromis lepisurus Bleeker, Atl. Ichth., ix, 1877, Pl. cccciii, fig. 7.

Heliastes lepidurus Day, Fish. India, 1878, p. 389, Pl. lxxxii, fig. 1.

Four specimens from Michaelmas Cay, where the species was quite common in large stocks of coral some distance from the shore; one of them is here figured. Mr. E. H. Rainford has collected this species at Holbourne Island, Queensland, but it has not hitherto been recognized from Australia.

Specimens are in the Australian Museum from Dauco Island reef, off Port Moresby, Papua (McCulloch); Howla Island, Solomons; Andaman Islands (Day collection); Vavau, Friendly Islands; and Aneiteum, New Hebrides.

AMPHIPRION PERCULA (*Lacépède*).

Lutjanus percula Lacépède, Hist. Nat. Poiss., iv, 1802, p. 239. New Britain.

Amphiprion percula Günther, Fische Südsee, vii, 1881, p. 225, Pl. cxxiv, fig. A. *Id.* Saville-Kent, Gt. Barrier Reef, 1893, pp. 33 and 145, chromo-pl. i.

Three specimens (1A.2760-1) from the folds of a large brown anemone (*Discosoma*) in shallow water, Michaelmas Cay. Saville-Kent states that these fishes take up their "residence within the gastric cavity of their host," but none observed by me entered the anemone's mouth, but ensconced themselves amongst its tentacles and ample folds.

Specimens in Austr. Mus. from Port Darwin, Murray Island, Cairns Reef, Two Isles, Hope Islands, Green Island; Solomons, Duke of York Island, Line Islands, and New Guinea.

Family CORIDÆ.

HALICHORES TRIMACULATUS (*Griffith*).

Julis trimaculata Griffith, Anim. Kingd. (Cuv.), x, 1834, Pl. xlv, fig. 2. Name and fig. only.

Julis trimaculata Quoy and Gaimard. Voy. "Astrolabe," Zool., iii, 1835, p. 705, Pl. xx, fig. 2. Vanikoro.

Halichœres trimaculatus McCulloch, Rec. Austr. Mus., ix, 3, 1913, p. 385.

One from Michaelmas Cay.

HALICHORES OPERCULARIS (*Günther*).

Platyglossus opercularis Günther, Cat. Fish. Brit. Mus., iv, 1862, p. 148. Fiji. *Id.* Playfair, Fish. Zanzibar, 1866, p. 95, Pl. xii, fig. 1.

One specimen (1A.2790) from Michaelmas Cay.

STETHOJULIS CASTURI *Günther*.

Stethojulis albovittata Bleeker, Atl. Ichth., i, 1862, p. 132, Pl. xliv, fig. 5. Not *Labrus albovittatus* Lacépède 1802.

Stethojulis casturi Günther, Fische Südsee, vii, 1881, p. 255, Pl. cxli, fig. A. Pelew Is., &c. *Id.* Jordan and Seale, Bull. U.S. Fish. Bur., xxv, 1906, p. 296, Pl. xlv, fig. 1.

A specimen (1A.2791) from Michaelmas Cay, 28th May, 1926, is the first to be recorded from Australia.

HINALEA AXILLARIS (*Quoy and Gaimard*).

Julis axillaris Quoy and Gaimard, Voy. Uranie, Zool., 1824, p. 272. Sandwich Islands.

Stethojulis axillaris Bleeker, Atl. Ichth., i, 1862, p. 136, Pl. xliv, fig. 3. *Id.* Jordan and Evermann, Bull. U.S. Fish. Comm., xxiii, 1, 1905, p. 283, fig. 121.

Two specimens from coral, Michaelmas Cay. Others in Austr. Mus. from Murray Island, Queensland; Lord Howe Island; New Guinea; and New Hebrides.

THALASSOMA DORSALE (*Quoy and Gaimard*).

Julis dorsalis Quoy and Gaimard, Voy. "Astrolabe," Zool., iii, 1835, p. 713, Pl. xv, fig. 5. Ile de France.

One from Michaelmas Cay.

Family PARAPERCIDÆ.

PARAPERCIS CYLINDRICA (*Bloch*).

Sciæna cylindrica Bloch, Nat. ausl. Fische, vi, 1792, p. 42 (*fide* Sherborn), and Ichtyologie, ix, 1797, p. 37, Pl. ccxcix, fig. 1. Locality unknown.

One specimen (1A.2705) on reef, Michaelmas Cay, 27th May, 1926.

Family TRICHONOTIDÆ.

TRICHONOTUS SETIGER *Bloch and Schneider*.

Trichonotus setiger Bloch and Schneider, Syst. Ichth., 1801, p. 179, Pl. xxxix (*T. setigerus* on plate). Eastern India. *Id.* Cuvier and Valenciennes, Hist. Nat. Poiss., xii, 1837, p. 316. *Id.* Bleeker, Nat. Tijd. Ned. Ind., vii, 1854, p. 251. *Id.* Rendahl, K. Svenska Vet. Akad. Handl., lxi, 9, 1921, p. 20, figs. 4a-c (scales).

Trichonotus polyophthalmus Bleeker, Nat. Tijd. Ned. Ind., v, 1853, p. 243. Ceram.

Trichonotus setigerus Günther, Cat. Fish. Brit. Mus., iii, 1861, p. 484. *Id.* Günther, Journ. Mus. Godeff., i, 4, 1873, p. 266. *Id.* Macleay, Proc. Linn. Soc. N.S. Wales, ii, 4, 1878, p. 359. *Id.* Klunzinger, Sitzb. Akad. Wiss. Wien, lxxx, 1, 1879, p. 396 (*lege* 376). *Id.* Schmeltz, Cat. Mus. Godeff., vii, 1879, p. 51. *Id.* Day, Suppl. Fish. India, 1888, p. 795, and text-fig. *Id.* Johnstone, Ceyl. Pearl Oyster Fish., ii, Suppl. Rept., xv, 1904, p. 215, Pl. i, fig. 7.

Trichonotus setifer Bleeker, Ned. Tijd. Dierk., iv, 1873, p. 233 (*fide* Weber and Beaufort 1911).

? *Trichonotus blochii* Castelnau, Res. Fish. Austr. (Vict. Offic. Rec. Philad. Exhib.), 1875, p. 22. Gulf of Carpentaria. *Id.* McCulloch and Whitley, Mem. Qld. Mus., viii, 2, 1925, p. 173.

A post-larval specimen, 33 mm. long, from Michaelmas Cay, has the following characters:—Head 7·5 mm., caudal 5, height 3, and ventrals 3. Eyes minute. Lower jaw longer than upper, with a large knob at the symphysis. One long dorsal, its anterior rays not differentiated from the others, arises over the pectorals. Dorsal and anal free from caudal; ventrals approximate.

Without reference to Castelnau's type, I am unable to state whether *T. blochii* is distinct from *T. setiger* or not.

The species has been recorded from Bowen by Schmeltz, but his record was unknown to McCulloch and Whitley when their list of Queensland fishes was compiled (1925, *loc. cit. supra*). Mr. E. H.

Rainford has collected two specimens from Bowen and noted the colours as "grey above, with a mauvy tinge; yellowish-white below. Rows of bright electric-blue spots along body and head." The Michaelmas Cay specimen was uniformly yellowish-brown. Rendahl has recorded this species from Cape Jaubert and Klunzinger noted it from Port Darwin, but it is evidently rare or very local, since it was not obtained by Dr. Paradice, who has made extensive collections of fishes in north Australia.

Family CALLIONYMIDÆ.

CALLIONYMUS MICROPS *Günther*.

Callionymus microps Günther, Fische Südsee, vi, 1877, p. 192, Pl. cxiii, fig. c. Tonga.

Synchiropus microps Jordan and Seale, Bull. U.S. Fish. Bur., xxv, 1906, p. 415.

Specimens in the Australian Museum from the outer barrier, St. Crispin Reef, Port Douglas, Queensland, and the New Hebrides. Three from pools on outer reef at Michaelmas Cay, where the species was common. New record for Australia.

Family ELEOTRIDÆ.

ASTERROPTERIX SEMIPUNCTATUS *Rüppell*.

Asterropterix semipunctatus Rüppell, Atl. Reise Nordl. Afrika, Fische, 1830-1, p. 138, Pl. xxxiv, fig. 4. Massowah, Red Sea. *Id.* McCulloch and Ogilby, Rec. Austr. Mus., xii, 10, 1919, p. 273 (references and synonymy).

Only two specimens from Michaelmas Cay. Abundant at North-West Islet, Capricorn Group (Whitley). Schmeltz[13] recorded this species from Bowen as *Eleotris cyanostigma*. The Australian Museum has specimens from Suva, Fiji.

EVIOTA VIRIDIS (*Waite*).

Allogobius viridis Waite, Rec. Austr. Mus., v, 3, 1904, p. 177, Pl. xxiii, fig. 3. Lord Howe Island.

Eviota zonura Jordan and Seale, Bull. U.S. Fish. Bur., xxv, 1906, p. 386, fig. 75. Apia and Pago Pago, Samoa.

Eviota viridis McCulloch, Rec. Austr. Mus., ix, 3, 1913, p. 386.

Six specimens, 19-23 mm. long, from Michaelmas Cay. Common in coral.

[13] Schmeltz.—Cat. Mus. Godeff., vii, 1879, p. 47.

Valenciennea longipinnis (*Lay and Bennett*).

Eleotris longipinnis Lay and Bennett, Zool. Beechey's Voy. "Blossom," 1839, p. 64, Pl. xx, fig. 3. Loo-Choo.

Valenciennea longipinnis McCulloch and Ogilby, Rec. Austr. Mus., xii, 10, 1919, p. 263.

One from Michaelmas Cay.

Family GOBIIDÆ.

Gobiodon verticalis *Alleyne and Macleay.*

Gobiodon verticalis Alleyne and Macleay, Proc. Linn. Soc. N.S. Wales, i, 1877, p. 333, Pl. xii, fig. 4. No locality = Darnley Island, Torres Strait (*fide* McCulloch). *Id.* McCulloch and Ogilby, Rec. Austr. Mus., xii, 10, 1919, p. 208, Pl. xxxii, fig. 2.

Life Colours.—Head and body green; vertical bars of reddish-brown cross the cheeks and bases of pectorals. Their place is taken by similarly coloured spots on the back, and spots coalescing to form short horizontal bands on the lower part of the sides. Fins all yellow; caudal and anal rays dark-tipped.

Locality.—Michaelmas Cay, off Cairns, North Queensland; coll. T. Iredale and G. P. Whitley, 24th May, 1926. Two specimens preserved.

Paragobiodon echinocephalus (*Rüppell*).

Gobius echinocephalus Rüppell, Atl. Reise Nordl. Afrika, Fische, 1830-1, p. 136, Pl. xxiv, fig. 3. Massowah, Red Sea.

Paragobiodon echinocephalus McCulloch and Ogilby, Rec. Austr. Mus., xii, 10, 1919, p. 239, Pl. xxxiv, fig. 1 (references and synonymy). *Id.* Whitley, Austr. Zool., iv, 4, 1926, p. 233.

Twenty-six specimens (1A.2712), 18-35 mm. long, from Michaelmas Cay.

Gobius ornatus *Rüppell.*

Gobius ornatus Rüppell, in Atlas zu Rüppell, Reise (Senckenb. Nat. Ges.), Fische (—), 1830 or 1831, p. 135. Massowah, Red Sea. *Id.* McCulloch and Ogilby, Rec. Austr. Mus., xii, 10, 1919, p. 227, Pl. xxxiii, fig. 2 (references and synonymy).

A specimen, 45·5 mm. long, from Michaelmas Cay has the following characters:—D.vi/10; A.9; Sc. 26; teeth pluriserial, tongue not notched; upper pectoral rays short, not yet silk-like. The spots of adults are larger than those of the young, especially on the fins. Surgeon-Lieutenant Lockwood found this species common around Hervey Bay, South Queensland.

Family SCORPÆNIDÆ.

SEBASTAPISTES *Streets.*

Sebastapistes Streets, Bull U.S. Nat. Mus., vii, 1877, p. 62. *Ex* Gill MS. Logotype, *Scorpæna strongia* Cuvier and Valenciennes.

SEBASTAPISTES BYNŒNSIS (*Richardson*).

Scorpæna bynœnsis Richardson, Ichth. Voy. "Erebus" and "Terror," 1845, p. 22, Pl. xiv, figs. 3-5. North-west coast of Australia.

A series of specimens in the Australian Museum shows that the orbital cirrhi may be present, poorly developed, or absent. The colour varies between ashy grey and brilliant brown and white, but the colour pattern is quite constant in more than fifty specimens. One from Murray Island has D.xiii/9.

The species was common under lumps of dead coral in shallow water at Michaelmas Cay, and remained practically motionless when exposed. One of the specimens from that locality had a long, thick orbital cirrhus; D.xi/i, 10; A.iii/5; about 22 modified scales on lateral line, and l. tr. 11/1/18.

Scorpæna tristis Klunzinger[14] and *S. bakeri* Seale[15], from the Red Sea and Guam respectively, may be synonyms of this species. *S. laotale* Jordan and Seale[16] certainly is identical, as topotypes from Samoa and specimens collected by A. R. McCulloch in the New Hebrides show.

Family CEPHALACANTHIDÆ.

DACTYLOPTENA ORIENTALIS *Cuvier and Valenciennes.*

Dactylopterus orientalis Cuvier and Valenciennes, Hist. Nat. Poiss., iv, 1829, p. 134, Pl. lxxvi. Indian Ocean.

A small specimen (1A.2714) washed up on the beach at Michaelmas Cay, 18th May, 1926.

Family BLENNIIDÆ.

TRIPTERYGION ATROGULARE *Günther.*

Tripterygion atrogulare Günther, Journ. Mus. Godeff., i, 1873, p. 267. Bowen. *Id.* Whitley, Austr. Zool., iv, 4, 1926, p. 235.

Life Colours.—Ground colour greyish; body with very irregular bars of dark brown and a few red dots on the sides; top of head flecked with red, a dark bar on the snout. Eye green; pupil black,

14 Klunzinger.—Synop. Fische Roth. Meers., Verh. Zool.-Bot. Ges. Wien, xx, 1870, p. 802 (*fide* Evermann and Seale, 1907); and Fische Roth. Meeres, 1884, p. 70.

15 Seale.—Occ. Pap. Bishop Mus., i, 3, 1901, p. 120.

16 Jordan and Seale.—Bull. U.S. Bur. Fish., xxv, 1906, p. 376, fig. 72.

surrounded by a coppery ring. Dorsal variegated with brownish; anal whitish with pink rays; pectorals whitish proximally and pink distally; ventrals whitish; caudal whitish with a few short brown bars on the rays.

Günther gives the colours as clear brownish; ventral surface of body and base of pectoral black; tail with a small black spot above and below, and a specimen from Port Denison in the Australian Museum conforms with his description, but another from the same locality agrees better with a series collected in coral at Michaelmas Cay, May, 1926. I have also obtained this species from North-West Islet, so that it seems to be fairly common along the entire Great Barrier Reef.

Petroscirtes punctatus (*Cuvier and Valenciennes*).

Blennechis punctatus Cuvier and Valenciennes, Hist. Nat. Poiss., xi, 1836, p. 287. Bombay.

Omobranchus punctatus Swainson, Nat. Hist. Fish. Amphib., ii, 1839, p. 274.

Petroscirtes punctatus Günther, Cat. Fish. Brit. Mus., iii, 1861, p. 231. *Id.* Schmeltz, Cat. Mus. Godeff., vii, 1879, p. 48.

One from Murray Island (Hedley and McCulloch); two from Michaelmas Cay. Schmeltz's record of this species from Bowen, Queensland, has been generally overlooked; it is evidently not a common species in Australia.

Salarias fasciatus (*Bloch*).

Blennius fasciatus Bloch, Nat. ausl. Fische, ii, 1786, p. 110 (*fide* Sherborn) and Ichtyologie, v, 1787, p. 91, Pl. clxii, fig. 1. East Indies.

Salarias fasciatus McCulloch, Rec. Austr. Mus., xiv, 2, 1923, p. 123, Pl. xv, fig. 3.

Five, 79-134 mm., from Michaelmas Cay; common.

Family BATRACHIDÆ.

Coryzichthys diemensis (*Lesueur*).

Batrachoides diemensis Lesueur, Journ. Acad. Nat. Sci. Philad., (n.s.), iii, 2, May, 1824, p. 402. "Van Diemen's Land (Peron)" = Shark's Bay, Western Australia. Specimen in the Jardin des Plantes, Paris; described from a drawing.

Batrachus quadrispinis Cuvier and Valenciennes, xii, 1837, p. 487. "Mer des Indes (Peron)." Probably based on Lesueur's specimen.

Batrachus diemensis Richardson, Ichth. Voy. "Erebus" and "Terror," ii, 1845, p. 17, Pl. viii, figs. 1-2.

Coryzichthys diemensis Ogilby, Ann. Qld. Mus., No. 9, 1908, p. 51. *Id.* McCulloch, Rec. Austr. Mus., xv, 1, 1926, p. 39.

Coryzichthys guttulatus Ogilby, Proc. Roy. Soc. Qld. xxiii, 1910, p. 42. Aru Islands.

Synonymy.—A co-type of *Coryzichthys guttulatus* Ogilby, in the Australian Museum (No. I.9486), has been compared by me with the large series of *C. diemensis* Lesueur in the same collection. I find no characters whereby Ogilby's species may be maintained as distinct.

Three specimens were caught at Michaelmas Cay, one of which was eating an octopus.

Family BALISTIDÆ.

BALISTAPUS ACULEATUS (*Linnæus*).

Balistes aculeatus Linnæus, Syst. Nat. ed. 10, 1758, p. 328. India.

Balistes (*Balistapus*) *aculeatus* Bleeker, Atl. Ichth., v, 1869, pp. 111 and 120, Pl. ccxvi, fig. 3.

Two specimens (IA.2695-6) from coral, Michaelmas Cay.

Family OSTRACIIDÆ.

OSTRACION TUBERCULATUM *Linnæus*.

Ostracion tuberculatum Linnæus, Syst. Nat., ed. 10, 1758, p. 331. India.

Ostracion (*Ostracion*) *tetragonus* Bleeker, Atl. Ichth., v, 1865, pp. 31 and 39, Pl. cci, fig. 2, and Pl. cciii, fig. 2.

One specimen (IA.2704) of this common Great Barrier Reef boxfish from Michaelmas Cay.

Family TETRAODONTIDÆ.

TETRAODON HISPIDUS *Linnæus*.

Tetraodon hispidus Linnæus, Syst. Nat., ed. 10, 1758, p. 333. India. *Id.* E. K. Jordan, Proc. U.S. Nat. Mus., lxvi, 1925, p. 42.

Tetrodon hispidus Linnæus, Syst. Nat., ed. 12, i, 1766, p. 411. *Id.* Günther, Fische Südsee, ix, 1910, p. 466, Pl. clxxvii.

Colours.—Two specimens of this species from Michaelmas Cay agree well with Günther's figure quoted above. The life colours of the larger, 15½ inches long, were as follows:—Greyish-brown suffused with olive-green on head, back, sides, and tail, speckled

with large whitish spots with nebulous edges. Belly whitish with irregular sub-horizontal prolongations of the greyish-brown colouring of the sides. Teeth white. Pupil of eye large, black, surrounded by bright golden yellow. Dorsal and anal plain greyish-brown, with a pale dusky blotch near tips, the rays yellowish. Pectoral rays bright yellow, the membranes hyaline. Base of pectoral and area surrounding axil and gill-opening black with bright yellow spots and bars.

This species, evidently common on the Great Barrier Reef, is very sluggish and may be caught by hand.

CANTHIGASTER BENNETTI (*Bleeker*).

Tropidichthys bennetti Bleeker, Nat. Tijd. Ned. Ind., vi, 1854, p. 504. Amboina.

Canthigaster bennetti McCulloch, Mem. Qld. Mus., vii, 4, 1922. p. 245.

One from Michaelmas Cay; others in Australian Museum from Murray Island and St. Crispin Reef, Queensland.

SOME POISONOUS AUSTRALIAN SPIDERS.

By

ANTHONY MUSGRAVE, F.E.S., Entomologist, Australian Museum.

(Plates ii-iii.)

IN the present contribution I describe and figure two species of spiders which hitherto have been unrecorded as harmful to man, and give a figure of and notes on the Red-spot Spider.

I desire to express my indebtedness to the artists who have prepared the illustrations, to my assistant, Mr. T. G. Campbell, for checking the counts of the teeth on the falx-sheaths, to Dr. I. Mackerras for help with references for the bibliography of Red-spot Spider bites, and to Mr. E. Osborne, of Collaroy, near Sydney, for assistance in securing material.

Family AVICULARIIDAE.

Sub-family DIPLURINAE.

Group ATRACEAE.

Genus ATRAX *O. P. Cambridge.*

1877. *Atrax* O. P. Cambr., Ann. Mag. Nat. Hist., (4), xix, p. 26. Orthotype *Atrax robustus* O. P. Cambridge.

1891. *Atrax* Simon, Ann. Soc. Ent. Fr., p. 302.

1892. *Atrax* Simon, Hist. Nat. des Araign., i, p. 186.

1901.* *Atrax* Hogg, Proc. Zool. Soc. Lond., p. 272.

1914. *Euctimena* Rainbow, Rec. Austr. Mus., x, 8, p. 248, fig. 58. Orthotype *Euctimena tibialis* Rainbow.

1914. *Atrax* Rainbow, *loc. cit.*, p. 252.

The genus *Atrax* includes eight species, *A. robustus* O. P. Cambridge, *A. modestus* Simon, *A. bicolor* Rainbow (originally placed in the genus *Aname*), *A. versuta* Rainbow, *A. valida* Rainbow and Pulleine, *A. formidabilis* Rainbow, *A. venenatus* Hickman, and *A. pulvinator* Hickman.

With the exception of *A. formidabilis,* which Rainbow placed tentatively in the genus, and *A. venenatus* Hickman, all the species have been described from female specimens and the males have been unknown. This probably accounts for Rainbow's action in placing a query before *A. formidabilis* in his description. This male

would have been the first of the genus to be recorded had he not described his *Euctimena tibialis,* which I propose to sink as a synonym of *A. robustus* O. P. Cambr., a few pages earlier. The males of *A. formidabilis* and *A. robustus* bear on the tibiæ of the second pair of legs an apophysis or spur covered with spines, while a smaller elevation is present on the metatarsi of the same pair of legs. As the metatarsi can be bent towards the tibiæ the smaller elevations come into juxtaposition with the larger ones, forming what are probably clasping organs. It is interesting to note that the tibial and metatarsal prominences of the second pair of legs occur also in the males of spiders of the American genus *Evagrus* Ausserer, group Macrotheleæ, which Simon,[1] places before *Atrax.* The male of *A. venenatus* Hickman[2] is apparently without these tibial and metatarsal prominences, groups of spines alone being present, judging by the figure of tibia ii.

Distribution.—Australia.

ATRAX ROBUSTUS *O. P. Cambridge.*

(Pl. ii, figs. 1-2, 4.)

1877. *Atrax robustus* O. P. Cambr., Ann. Mag. Nat. Hist., (4), xix, p. 26, Pl. vi, fig. 1, ♀, New Holland.

1891. *Atrax robustus* E. Simon, Ann. Soc. Ent. Fr., lx, p. 301.

1901. *Atrax robustus* Hogg, Proc. Zool. Soc. Lond., p. 273, text fig. 39; ♀ ♀ in British Museum from Queensland and New South Wales, and in Paris Museum from New South Wales.

1914. *Euctimena tibialis* Rainbow, Rec. Austr. Mus., x, No. 8, p. 249, text figs. 58-60; ♂ ♂ Turramurra and Mosman, Sydney.

Brief descriptions of the male and female figured are given below, otherwise they conform to Rainbow's (1914) and Hogg's (1901) diagnoses.

♂ Register number K56169 (Pl. ii, fig. 2). Cephalothorax 12·3 mm. long, 10·3 mm. broad; abdomen 11·2 mm. long, 9·8 mm. broad.

Cephalothorax.—Black, shining, smooth. *Abdomen.*—Dull brown, covered with long black spine-like hairs. Ventrally the body is reddish-brown except for the coxæ.

Eyes.—Conform to original description, except that the front median eyes are separated by a space slightly less than their individual diameter.

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[1] Simon.—Histoire Naturelle des Araignées, 2nd ed., i, 1892, p. 185; and ii, Suppl., 1903, p. 968.
[2] Hickman.—Pap. Proc. Roy. Soc. Tasm., 1926 (1927), p. 65, text-fig. 9, and Pl. vi, fig. 5.

Legs.—Conform for the most part to the description of the allotype, except that patella ii is equipped with two strong spines on underside, not four as in the allotype. These numbers are subject to variation, specimen K56172 having eight-twelve on the right and left patella i, and six-five on patella ii. This would indicate that the number of spines can be of little specific value, though their presence or absence may be of importance. The apophyses on tibiæ ii are conical in shape; this character at once differentiates the male from *A. formidabilis* Rainbow, in which the apophyses are rounded (Pl. ii, fig. 4). In the drawing of the spider the second pair of legs are twisted to show the apophyses; normally they project downwards and are not visible from above.

Measurements of the legs are given below in millimetres:

Legs.	Coxa.	Trochanter and Femur.	Patella and Tibia.	Metatarsus and Tarsus.	Total
1	5·2	10·7	11·4	12	39·3
2	4·8	10·5	11	11·7	38
3	4·3	10·3	10	11·7	36·3
4	4·5	10·5	11·8	13	39·8
Palpi	4·4	6·9	6·9	Tarsus 2·2	20·4

Falces.—In Rainbow's description of the allotype he states, "the outer ridge of the furrow of each falx armed with ten strong teeth and the inner ridge with fifteen of varying lengths; in addition to these there is an intermediate row of six small teeth near the base;" upon examining the allotype I find that the rows of teeth are as follows:—

Right falx-sheath, outer row 13, intermediate row 18, inner row 7.
Left falx-sheath, outer row 14, intermediate row 18, inner row 16.

In the specimen under consideration the formula reads:—
Right falx-sheath, outer row 14, intermediate row 18, inner row 13.
Left falx-sheath, outer row 13, intermediate row 20, inner row 13.

♀ Register number K56197 (Pl. ii, fig. 1). Cephalothorax 14 mm. long, 10·6 mm. broad; abdomen 18·3 mm. long, 14·4 mm. broad.

Cephalothorax.—Above red-brown, smooth, shining. *Abdomen.*—above black-brown covered with hairs. Ventrally the body is light reddish-brown. Sternum redder than rest of undersurface.

Eyes.—Front median eyes separated by a space slightly more than their individual diameter.

Legs.—No spines on tibia ii, all other tibiæ bespined. Patellæ i-iv bespined. (Spines are present on tibia ii in other specimens of the series.)

Measurements of the legs are given below in millimetres:

Legs.	Coxa.	Trochanter and Femur.	Patella and Tibia.	Metatarsus and Tarsus.	Total.
1	6·4	11·4	12·2	9·7	39·7
2	4·7	8·3	8·3	7·5	28·8
3	4·6	9·3	9	9	31·9
4	4·8	10·8	11·2	11·4	38·2
Palpi	5·3	7·7	7·2	Tarsus 4·7	24·9

Falces.—Hogg (*supra*) has stated that "there are 13 large teeth on the outer margin of the falx-sheath, 11 on the inner, and 9 rather large in an intermediate row." In the specimen under consideration the numbers are as follows:—

Right falx-sheath, outer row 14, intermediate row 21, inner row 13.
Left falx-sheath, outer row 16, intermediate row 25, inner row 15.

The intermediate row usually consists of a number of small teeth at the end of the furrow underlying the point of the fang, and a row of larger ones extending in a line towards the fang and terminating before the fourth or fifth teeth of the inner and outer rows.

Variation.—The number of teeth in the rows in the falx-sheath of this species varies considerably, and below is given a table of the

	Left Falx-Sheath.			Right Falx-Sheath.		
♀	Outer Row.	Inter-mediate Row.	Inner Row.	Inner Row.	Inter-mediate Row.	Outer Row.
K14066	14	26	14	12	34	13
K36614	13	35	18	17	35	13
K46840	15	23	15	16	33	13
K49421	13	22	15	14	19	12
K49955	11	20	15	15	24	13
K55650	14	26	13	10	23	14
K56194	13	21	15	14	21	13
K56197	14	21	13	15	25	16
K56215	15	33	15	17	34	13
K56217	13	28	14	15	33	11
K56261	12	31	14	13	31	13
K56262	14	24	13	13	22	14
Average	13	25-26	14	14	27–28	13
♂						
K 2879	12	18	11	14	22	12
K 3363	13	18	7	16	18	14
K40241	13	14	13	13	16	14
K41669	12	22	16	13	23	11
K56151	13	17	16	13	17	13
K56152	12	24	13	13	22	14
K56169	14	18	13	13	20	13
K56172	13	27	13	16	23	13
Average	12–13	19	12–13	13	20	13

number of teeth in the rows of the falces of specimens in the Australian Museum collection. For convenience, the rows are placed in the table in the order they would appear if the specimen were viewed ventrally; the right falx is thus seen as the left, and the left as the right.

Hab.—New South Wales, Colo Vale, July, 1902, 1 ♀, K14066, collected by Mr. N. Etheridge.

Localities near Sydney: Willoughby, Jan., 1915, 1 ♀, K36614, collected by Mr. A. E. Ansell; Chatswood, May, 1924, 1 ♀, K49421, collected by Mr. P. E. B. Barnett; Artarmon, Nov., 1922, 1 ♀, K46840, collected by Mr. P. M. Longworth; Gordon, Feb., 1927, 1 ♀, K55650, collected by Mr. E. Mazlin; Belmore, Aug., 1924, 1 ♀, K49955, collected by Mrs. M. Codd; Artarmon, April, 1927, 1 ♀, K56194, collected by Miss Steward; Chatswood, May, 1927, 1 ♀, K 56197, collected by Mrs. J. E. Watson; Greenwich, May, 1927, 1 ♀, K56215, collected by Mr. H. Switzer; Collaroy, May, 1927, 1 ♀, K 56217, collected by Mrs. Mackney; Collaroy, May, 1927, 1 ♀, K56261, collected by Mr. E. Osborne; Collaroy, May, 1927, 1 ♀, K56262, collected by Mr. E. Osborne; Killara, May, 1927, 1 ♀, collected by Mr. W. H. Boekemann; Cremorne Heights, N. Sydney, June, 1927, 1 ♀, collected by Mr. F. L. Grutzmacher; Hornsby, June, 1927, 1 ♀, collected by Mrs. E. Wheatley; Pennant Hills, 1927, 1 ♀, collected by Mr. Spence; Manly, Sept., 1927, 1 ♀, collected by Mr. L. Bulmer. (The teeth on the falx-sheaths of the last five specimens have not been counted, and so do not appear in the list.)

Turramurra, March, 1897, 1 ♂, K3363, collected by Mr. C. F. Richmond (allotype); Mosman, Dec., 1896, 1 ♂, K2879, collected by Mr. E. R. Waite and described with allotype; Neutral Bay, June, 1917, 1 ♂, K40241, collected by Mr. A. Musgrave; Greenwich, April, 1927, 1 ♂, K56151, collected by Mrs. H. Willoughby; Wahroonga, March, 1919, 1 ♂, K41669, collected by Miss Scrutton; Hornsby, April, 1927, 1 ♂, K56169, collected by Mr. A. S. Wheatley; Wahroonga, April, 1927, 1 ♂, K56152, collected by Mr. F. W. Brennan; Collaroy, April, 1927, 1 ♂, K56172, collected by Mr. E. Osborne; Collaroy, June, 1927, 2 ♂, collected by Mr. E. Osborne; Clifton Gardens, N. Sydney, June, 1927, 1 ♂, collected by Dr. C. A. Monticone; Thornleigh, Feb., 1927,, 1 ♂, collected by Mr. W. Thompson; Manly, Sept., 1927, 1 ♂, collected by Mr. L. Bulmer. (The teeth on the falx-sheaths of the last five specimens have not been counted, and so do not appear in the list.)

Remarks.—The recent death of a baby boy at Thornleigh, near Sydney, following on the bite of a trap-door spider[3], has caused great public interest in spiders and many have been sent to the Australian Museum for determination. Through the courtesy of the Thornleigh police the spider actually responsible for the child's

[3] The term "trap-door" spider is used here to embrace broadly all the members of the family Aviculariidæ. The members of the sub-family Diplurinæ do not construct trap-doors to their burrows, which they place under stones, logs, and in tree stumps.

death was brought to the Museum, and I found that it agreed with the holotype of *Euctimena tibialis* Rainbow, a species originally recorded from Turramurra and Mosman, near Sydney, and of which only the male had been described. Since the death of the child seven male specimens have been forwarded to the Museum from localities near Sydney. The fact that males alone were known of this apparently not uncommon species, led to the conclusion that the female would probably be known under some other name. Upon receipt of another trap-door spider, *Atrax robustus* O. P. Cambr., from Artarmon, near Sydney, I was at once struck by the similarity of the maxillæ, labium, eye-structure, and dentition of the falces to those of *Euctimena tibialis*. Reference to the literature upon *A. robustus* showed that the male was unknown. Upon *a priori* evidence, as well as upon that of structure, it would appear that *Euctimena tibialis* Rainbow should fall as a synonym of *Atrax robustus* O. P. Cambridge.

The discovery by Mr. E. Osborne of two females and two males on the same small block of land at Collaroy seems to confirm beyond all reasonable doubt the views propounded above. A female has also been received from Mrs. J. Harmer, taken at Mr. Spence's residence at Pennant Hills, which is situated about a mile from Thornleigh, where the child was bitten. Mr. L. Bulmer has since collected a male, female and egg-sac from the same nest, at the residence of Mr. T. C. Campbell at North Harbour, Manly, while excavating the foundations of a retaining wall.

An analysis of the localities of the specimens in the Australian Museum listed above, shows that all the males and fifteen of the seventeen females have been taken on the northern side of Port Jackson.

A female taken by Mr. Osborne at Collaroy, near Sydney, was dug out of its nest in a cavity in a gum-tree stump about eighteen inches below the surface of the ground. Portion of the silken lining of the burrow contained remains of beetles, which had evidently formed the food supply of the spider. This spider was alive when brought to the Museum; the fangs were bright red in colour, the undersurface of all the leg joints and base of the falces light-green, and the upper parts a dark-green.

Atrax robustus is undoubtedly of a pugnacious disposition, all those brought alive to the Museum showing fight, a characteristic which appeared to have impressed itself on the minds of those who presented the specimens. Most of the spiders were taken in gardens, but four of the males were taken inside houses, one taken by Mr. Osborne, springing at him.

Rainbow and Pulleine have stated[4] in regard to *A. valida*, "Like others of the genus *Atrax*, this species is of a vicious disposition, and puts up a strong fight before it can be induced to enter a collecting

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[4] Rainbow and Pulleine.—Rec. Austr. Mus., xii, 7, 1918, p. 86.

tube." Mr. Hickman corroborates this statement in respect of his *A. venenatus* from Tasmania[5].

On Monday, 20th June, 1927, a male specimen was submitted to me for identification on behalf of Mr. C. A. Monticone, LL.D., of Clifton Gardens, Sydney. The spider had bitten him on the ball of the left foot while he was exercising in his room that morning. Later in the day Dr. Monticone informed me by telephone that, after being bitten, he took no notice of the bite and treated it as if it were a mosquito bite. He had not seen a doctor, though he was suffering great pain at the time. I advised him, therefore, to get medical advice without delay, and asked him to let me have all particulars of his case. I saw him at the Museum five days later, and he handed me a typed account of his case, set out with commendable thoroughness. This is given below. Dr. Monticone further expressed the opinion that a child under the age of fifteen years would have little hope of recovering from the effects of a bite.

Effects of Bite.—An account of the fatal results from a bite of a male of this spider, and the circumstances surrounding it, is here given as it appeared in *The Sun,* Wednesday, 23rd February, 1927.

The story of how a spider bite proved fatal was told at the Hornsby Coroner's Court to-day, when the District Coroner (Mr. H. Richardson Clark) held an inquiry into the death of a baby boy, Clyde William Thompson, of Thornleigh. Constable Harmer, of Thornleigh, said that on February 15 the little boy was sitting on the laundry steps, with his parents close by, at their home in Clifford-avenue, Thornleigh. Suddenly with an agonising scream the child jumped up. Mrs. Thompson picked him up and hurried him into the kitchen.

On examining him she found a spot of blood in the little finger of the left hand. Then her husband found a big black spider, partly crushed, near where the child had been playing.

A ligature was bound around the left hand, and the wound bathed with permanganate of potash, but the child became ill and died a few hours later.

Constable Harmer produced the spider—a big black one. He said that the museum authorities had told him that it was a trap-door spider, Euctimena tibialis Rainbow. This was the first case on record of a person dying from the bite of a trap-door spider. He was of the opinion that the child was crushing the spider in his hand when it bit him.

Wm. Chas. Thompson (father) and Laura Thompson (mother) both said that they did what they could for their child and took it to the doctor when they saw that it was in a bad way.

Dr. Neville Davis, of Beecroft, said that when he saw the child, which was at 8.20 on the evening of February 15, it was unconscious, deeply cyanosed, and in a state of chronic [*sic*] convulsive spasm. He instituted a vigorous treatment for an hour and a quarter, but although the child rallied occasionally, he was unable to save it. "I realise," he said, "that death from a spider bite is an extremely rare occurrence, but in this case it was due to the following reasons:—The ligature was not applied soon enough or kept on long enough to prevent the poison reaching the central nervous system by way of the blood stream; also, through want of knowledge, the wound was not scarified."

The Coroner found that the child had died from the effects of the spider bite.

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[5] Hickman.—Pap. Proc. Roy. Soc. Tasm., 1926 (1927), p. 70.

In setting forth Dr. Monticone's case I have been assisted by Dr. Ian Mackerras, of the Board of Health, in revising the Doctor's notes. (The light way in which Dr. Monticone treated the matter, though suffering considerable pain at the time, would indicate that fear in no way aggravated his condition.)

Age 42, weight about 10 stone. Normal strength, and good health and constitution. No organic troubles of any kind.

Monday, 20th June, 1927, 6.10 a.m. While doing physical culture exercises in pyjamas and bare feet in a room opening on to a garden about three feet away, I felt something under my left foot. It was dark at the time and I rubbed my foot on the carpet, thinking it was a button or other small object. Suddenly I felt a severe prick as from a pin. I looked and saw something dark and wrenched it off with some effort, and noticed then it was something moving. I turned on the light and killed a spider. I then went into the bathroom, where I squeezed some liquid out from the bitten foot. Two small punctures were visible, similar to thorn holes, though hardly noticeable. I applied iodine and had a cold bath, though a stinging pain was in the foot all the time similar to that of a bee-sting, and gradually extending to the toe and the rest of the foot.

6.45 a.m. A peculiar numbness of tongue and loss of taste was noticed, and a twinging pain in the tonque and lips similar to that of a strong electric current running through the throat, or the sensation left on the hands after carrying ice or snow for a long while. I then had breakfast of strong coffee (large quantity) and toast.

7.30 a.m. About this time the pain extended to both hands and feet, with a strange sensation as though something cold was touching the skin. I felt very sensitive to cold air or water.

8 a.m. (approx.). I felt pains in both arms and legs and had annoying and excessive salivation, necessitating continuous spitting. I had also a discharge of mucous matter from my nose, very clear and identical to that of a person with a cold, though I had no cold at the time. The most troublesome symptoms were the twitching of all facial muscles, especially the lips, which kept on moving involuntarily, and the muscles at the base of the nose and those of the cheeks. My face felt as though the whole surface were a boil ready to burst, and with a sensation similar to that of a limb which has "gone asleep."

10 a.m. About this time I felt considerable depression, my eyes lachrymating, and I was able to control the eyelids with difficulty. I had a strong feeling of nausea, a choking feeling in the throat and obstruction of the nasal passages. A good dose of coffee taken had no effect. About 10.30 my vision became very blurred so that several images appeared partially covering and mixing into one another, and I had a certain amount of difficulty in controlling my limbs, hands, and feet, all being very numb and extremely sensitive to cold. Heat afforded partial relief, only to cause greater pain afterwards.

11.30 a.m. My symptoms became more and more severe, until about this time I found it impossible to write a word on the typewriter owing to distorted vision, weakness, numbness, and feeling of pains and depression.

12 noon. About this time I visited Sydney Hospital and obtained a prescription from Dr. A. R. H. Duggan to counteract alkaloid poison. The prescription contained the following:—Ammonium bromide gr. x, pot. citrate gr. xxv, sodium salicylate gr. xxv.

1.30 p.m. I returned home, had a small lunch, and went to bed. During the afternoon the feeling of "tingling" extended to my hips, shoulders and back. All symptoms continued until late in the night with tendencies to nausea, while in addition to spitting and sneezing, which were most pronounced and uncomfortable, was a "tingling" of all muscles.

Tuesday 21st June, 1927. The sneezing, spitting and belching subsided, but the tingling remained, becoming sharper here and there at irregular intervals. A cold sponge bath caused an unpleasant reaction, which was partly counteracted by large doses of boiling coffee. My feet, hands, and facial muscles are still affected. My general condition is similar to that of a patient after influenza, that is, tired, depressed, numb.

Wednesday, 22nd June, 1927. Only my hands and feet are still tingling at intervals, and the bitten foot is still slightly sore.

Thursday, 23rd June, 1927. No further symptoms except a drowsy and tired feeling.

Notes: No alcohol was taken at any time, only large doses of coffee, which did not seem to check the trouble, but certainly helped to keep the body a little warmer. It is remarkable that only the front part of the head was affected (of course, also the respiratory passages), and especially the muscles of lips, tongue, mouth, and jaws. (I forgot to mention above that right through the severest period my teeth and jaws ached as with severe neuralgia). No disagreeable sensation, however, was felt at the top or back of the head, or about the ears. On the other hand, no sensation was experienced at all in the front part of chest or abdomen, but only on the back of the shoulders and right down to the legs. My taste was completely lost for thirty-six hours. The prescription was certainly very effective, as proved by the fact that while it was in the mouth the tongue ceased paining at once, but when the medicine was swallowed the tongue commenced to ache again. After the first two doses the trouble began to decrease. I noticed, also, that my temperature and pulse remained rather regular, though my pulse was a little weak at intervals. I noticed, too, that the local pain was, after the first hour, not more pronounced than anywhere else; the right foot (not bitten) ached as much as the left (bitten). I noticed no trouble at all internally.

ATRAX FORMIDABILIS *Rainbow*.

(Pl. ii, figs. 3 and 5.)

1914. ? *Atrax formidabilis* Rainbow, Rec. Austr. Mus., x, 8, p. 255, figs. 63-66. ♂ Richmond River, N.S. Wales.

The specimen figured is from Wauchope, N.S. Wales, and is much larger than the holotype. The following notes on it may prove of value.

♂. Cephalothorax 14·7 mm. long, 10·4 mm. broad; abdomen 13·8 mm. long, 9 mm. broad.

Falces.—Outer ridge of each falx armed with twelve teeth and the inner ridge with eleven, the intermediate row consisting of eighteen minute teeth. In the description of the holotype, fourteen is stated to be the number for the intermediate row, but examination of the type shows that eighteen are present.

Legs.—All tibiæ bespined, very heavily on tibiæ i, ii, iii. The patellæ are also furnished with spines. Tibia and metatarsus ii on the underside are each produced towards the middle into a spur or apophysis (Pl. ii, fig. 3). In the plate these protuberances are seen from the side, the limb being twisted into an unnatural position to show these important characters, but normally they project downwards. Each spur is densely covered with spines (Pl. ii, fig. 5) and hairs.

Measurements of the legs are given below in millimetres:—

Legs.	Coxa.	Trochanter and Femur.	Patella and Tibia.	Metatarsus and Tarsus.	Total.
1	6·4	13·4	13·4	12·7	45·9
2	5·3	12	12	13·2	42·5
3	4·7	11	10·5	12·8	39
4	5·2	13·3	13·3	13·9	45·7
Palpi	5·3	8	8	Tarsus 2·6	23·9

Hab.—New South Wales, Wauchope, January, 1926, 1 ♂, forwarded by Dr. Wm. Begg to Health Department, Sydney.

Remarks.—In January, 1926, I received from the Department of Public Health, Sydney, for identification a trap-door spider, which I was informed had bitten a man residing at Wauchope, N.S. Wales. A copy of the letter which was sent with the specimen to the Department by Dr. W. Begg, of Wauchope, is given below, and shows what painful results may be attendant on a bite of this spider. Upon examination, the spider proved to be identical with the type of *Atrax formidabilis* Rainbow, of which at present only males are known. It is a large spider, with a body length of 27·5 mm. in the holotype and 36 mm. in the Wauchope specimen. It may easily be identified by the large rounded process on each tibia of the second pair of legs and the smaller process on each adjoining metatarsus.

Effects of Bite.—Dr. W. Begg's letter is given below. I subsequently learnt that the patient recovered.

Wauchope, 21/1/26.

Secretary,
Bacteriological Bureau,
Public Health Dept.,
Sydney.

Dear Sir,

Under separate cover please find specimen of spider. I would be obliged if you would identify same and let me know any particulars you may have at hand about same.

The specimen in question bit an adult man on the buttock when in the act of dressing, the spider evidently getting on the trousers in the night. He knocked it off and it fastened on his finger. Pain in the region of the bites was intense from the first and then the parts became numb. The bites were not scarified, and when I saw him three hours later he had had intense vomiting, profuse perspiration, violent cramps in the limbs and abdominal muscles, and the regions of the punctures were still so numb he did not mind incisions into them. He was more or less delirious, thinking somebody was spraying him with something. He had a frightened, anxious look, slow, weak pulse, 60 per m. Respirations laboured, and coughing up quantities of mucous, saliva trickling from the mouth, and pupils contracted.

I am,
Yours faithfully,
(Sgd.) WM. BEGG.

Family THERIDIIDAE.

Genus LATRODECTUS *Walck.*

1805. *Latrodectus* Walck., Tabl. Ar., p. 81. "Haplotype" *Aranea tredecim-guttata,* Rossi.

Distribution.—Tropical and subtropical regions of the world.

LATRODECTUS HASSELTII, *Thorell.*

(Pl. iii.)

1869. "Katipo" Wright, Tr. N.Z. Inst., ii, pp. 81-84.

1870. *Lathrodectus Hasseltii,* Thorell, Oefv. af Kongl. Vetensk. Akad. Forh., p. 369. New Holland.

1870. *Lathrodectus scelio* Thorell, *loc. cit.* p. 370. New Holland.

1870. *Latrodectus katipo* Powell, Trans. N.Z. Inst., iii, p. 56, Pl. v.

1872. *Latrodectus Hasseltii* L. Koch, Die Arach. Austr., i, p. 276, tab. xxiii, figs. 2, 3, 3*a*. Rockhampton and Bowen.

1872. *Latrodectus scelio* L. Koch, *loc. cit.,* p. 279, tab. xxiii, fig. 4. Rockhampton and Bowen.

1905. *Latrodectus hasseltii* Rainbow, Rec. Austr. Mus., vi, 1, p. 28.

1914. *Latrodectus hassellti* Pulleine, Trans. Roy. Soc. S. Austr., xxxviii, p. 448. Finke River, Central Australia.

Distribution.—Throughout Australia, New Zealand, S. Pacific Islands, India, Malaysia, Papua, and Eastern Arabia.

Remarks.—The above species, popularly known in Australia as the Red-back, Red-spot, Red-striped, or Jockey spider, was hitherto the only Australian spider known to cause injury to man by its bite. The habits of the spiders of the genus *Atrax* (Aviculariidæ) and those of the genus *Latrodectus* (Theridiidæ) are very different, those of the former bringing them but rarely into the sphere of man's activity. We need not expect, therefore, to hear of many persons being bitten by trap-door spiders, the three cases cited in this paper being the only ones of which I have been able to obtain any record. The prevalence of Red-spot spider bites, on the other hand, may be gauged by reference to the appended bibliography. While it is perhaps significant that two species of *Atrax* are here recorded for the first time as harmful to man, it is well to bear in mind that the other one hundred and forty-six species of Australian Aviculariids are potentially capable of inflicting suffering to man from their bites. Trap-door spiders live in the ground or under logs, occurring usually in the bush and gardens, and but seldom invading houses. The Red-spot spider, as Rainbow (*supra*) points out, builds

its web "in all sorts of dark corners, in old and empty cans, or amongst any loose rubbish; they also occcur under stones and rock shelters." Dr. Lethbridge and Dr. Vance have indicated that its favourite haunt is under the seats in closets in country districts where the earth closet is in vogue. Dr. Bogan[6], of Los Angeles, points out that *L. mactans,* which occurs in California and the southern states of America, has similar habits, and the majority of the patients bitten by this spider were bitten "while sitting in an out-door privy."

Effects of Bite.—The nature and effects of the Red-Spot spider toxin have been frequently touched upon by doctors, and attention is drawn to the bibliography of references to Red-spot spider bite which have appeared from time to time in medical publications. It will be seen that the consensus of medical opinion is strongly against the spider. Only one fatal case of a child having been bitten is definitely recorded (by Dr. Jackson), and Dr. Lethbridge writes that he knows of three fatalities[7], and there are no records of death at the Department of Public Health, Sydney, but the painful results from the bite and frequency of the cases lead to the conclusion that the "Red-spot" is our most poisonous spider.

BIBLIOGRAPHY OF REFERENCES TO RED-SPOT SPIDER BITES.

Balfour, A.—Letter, *Med. Journ. Austr.*, 11th June, 1927, p. 873. Refers to Dr. Miles's letter of 5th March, 1927, in which he states that he can "find no reference to the condition in text-books." Gives references to books and papers treating with spider bites.

Cleland, J. B.—Sixth Report of the Government Bureau of Microbiology. Injuries and Diseases of Man in Australia attributable to Animals, except those due to Snakes and Insects. (b). No. 2. In *Report of the Director, Public Health, N.S.W.*, for the year ended 31st December, 1915 (1916), pp. 271-275. Lists cases up to 1916.

Jackson, E. S.—Letter, *Med. Journ. Austr.*, 2nd April, 1927, p. 525. Records fatal case of little boy of three or four years.

Lethbridge, H. O.—Letter, *Med. Journ. Austr.*, 28th Jan., 1922, p. 113. Writes from Narrandera, and states that the spider is called the Jockey spider in the Riverina, where "it inhabits wooden box seats of cess-pits. Eighty per cent. of the cases treated have been bitten round the genitals."

Letter, *Med. Journ. Austr.*, 30th April, 1927, p. 664. States that he knows of three fatalities. Has treated thirty cases. "All

[6] Dr. E. Bogan.—Arachnidism: A Study in Spider Poisoning. Journ. Amer. Med. Assoc., lxxxvi, 1926, p. 1894.

[7] One of these cases is shown by Dr. F. A. Rodway (see Bibliography) to be that of the child bitten by *Euctimena tibialis* = *Atrax robustus*.

of them have been extremely ill." (See Dr. Rodway's letter of 21st May, 1927).

McKay, S.—Letter, *Med. Journ. Austr.*, 23rd April, 1927, p. 626. Discusses treatment and nature of toxin.

Miles, E. H.—Letter, *Med. Journ. Austr.*, 5th March, 1927, p. 353. Notes that in the last four years he has had "the opportunity of studying the effects of bites in nine cases, none of which proved fatal." Describes the result of bite and treatment, and states that "I can find no reference to the condition in text-books, etc."

Rodway, F. A.—Letter, *Med. Journ. Austr.*, 14th January, 1922, p. 54. Refers to Dr. Sutherland's letter, 31st December, 1921, and states that spiders "were very common in Barraba, but for five years neither my colleagues nor myself ever treated a bite, nor did I ever get direct evidence of any person being bitten by one."

Letter, *Med. Journ Austr.*, 21st May, 1927, p. 770. Refers to Dr. Lethbridge's letter, 30th April, 1927, in which he stated that "the recorded death of a child to-day makes the third fatality I know of," and points out that this last death was due to *Euctimena tibialis*, vide *The Sun*, 23rd February, 1927, and not to the Red-spot spider as Dr. Lethbridge had supposed. "I have handled these spiders on many occasions for years past and have not yet succeeded in making one bite me."

Sutherland, J. W.—Letter, *Med. Journ. Austr.*, 31st December, 1921, p. 632. Writes from Narromine and says that common Red-back spider (*Latrodectus hasselti*) is found everywhere here, and cases of Red-back spider "bite" are very numerous. "Such a bite usually means a week of continuous aching and pain, accompanied by drenching sweats."

Letter, *Med. Journ. Austr.*, 21st Jan., 1922, p. 84. Refers to Dr. Rodway's letter of 14th Jan., 1922. States that he was bitten by spider which was identified by Mr. W. W. Froggatt. Govt. Entomologist, as *Latrodectus hasseltii*, and has seen five cases of red-back spider bite in the past three weeks; the patients all saw the spiders.

Tidswell, F.—Researches on Australian Venoms. The Poison of the Red-Spotted Spider, pp. 77-79. Gives records of experiments with spiders, and states that "The results may, however, be taken as indicating the improbability of a fatal issue from poisoning by *Latrodectus Hasselti*."

Vance, E. B. M.—Letter, *Med. Journ. Austr.*, 28th Jan., 1922, p. 113. Writes from Leeton and comments on Dr. Rodway's letter. "Every year, principally in the summer, I am called upon to treat at least half a dozen cases of 'red back' spider bite,

and this experience has convinced me that *Latrodectus hasselti* is both vicious and venomous. Its favourite haunt is under the seat of a closet, across the opening of which it spins its web, and this accounts for the fact that in the majority of cases human beings are bitten on the genitals." Gives effects of bite and references to subject.

Watkins, A.—Letter, *Med. Journ. Austr.*, 11th June, 1927, p. 873. Refers to Dr. Rodway's letter, 21st May, 1927, of the failure of the Red-spot spider to bite him. Suggests that "if Dr. Rodway placed the spider under his shirt, I fancy he would be accommodated."

CONTRIBUTIONS TO THE KNOWLEDGE OF AUSTRALIAN HEMIPTERA.

No. I.

By

Anthony Musgrave, F.E.S., Entomologist, Australian Museum.

(Plate iv.)

As occasion offers I intend to contribute, under the above title, descriptions and notes on Australian Hemiptera. In the present paper I describe and figure a new genus and species of Fulgoridæ, and give notes on an allied species.

Through the courtesy of Mr. L. Franzen, of Brisbane, Queensland, I have been permitted to examine a pair of Fulgoroids sent to him for identification by Mr. T. A. Cole, of Chinchilla, Queensland. These I consider to constitute a new genus and species, and Mr. Cole has kindly permitted me to retain the types for the Australian Museum collection.

Family FULGORIDAE.

Genus Desudaboides *nov.*

Head, including eyes, as broad as pronotum, anterior margin convex, the margins strongly ridged; disk glabrous; face broader than long, longer than clypeus, its base convex and extending well in front of eyes, the lateral margins not parallel, sinuate and slightly widened at the base, medially tricarinate, carinations wider anteriorly than posteriorly; clypeus broader than long; rostrum extending as far as hind coxæ. *Mesonotum* tricarinate. and medially a little longer than the head and pronotum together; posterior tibiæ with three spines. *Tegmina* more than three times as long as broad, the apices pointed; wings broader and shorter than tegmina.

Allied to *Desudaba* Walker, but at once distinguishable by the broad head and pointed wings.

Genotype.—D. fuscomaculata sp. nov.

Desudaboides fuscomaculata *sp. nov.*

(Pl. iv, figs. 1-3.)

♀ Length 11·5 mm., width across eyes 4·8 mm., width of abdomen 4·8 mm., length of tegmen 13·2 mm., length of posterior tibia 4·4 mm. (Dorsal aspect Pl. iv, fig. 1.)

Head, pronotum, and mesonotum ranging in colour from greenish-yellow to brown; metanotum orange, raised portions black; upper surface of abdomen orange, segmental margins darker orange, ventral surface verdigris-green, anterior borders of the two most posterior segments blackish; rostrum and legs dull ochraceous, the legs annulated with black.

Head with two confluent black spots on anterior margin, which send back medially a black line to the raised anterior border of the vertex, the appearance of the front of the head being that of two green spots enclosed by irregular black markings. Near each lateral margin of vertex is a black spot; face with two black spots situated in line with the antennæ and in the depressions between the median tricarination and the lateral margins. Clypeus bearing in the centre two irregular reddish-black spots (Pl. iv, fig. 3).

Pronotum with four black spots situated near the anterior margin.

Mesonotum with seven confluent black spots arranged along the anterior margin, a row of four black spots extending from the lateral margins to the centre of the disk, and two smaller black spots situated further back, each of which gives off a fuscous-black line which runs along the lateral margin to meet at the apex of the mesonotum; a fuscous-black spot is situated within the V thus formed.

Tegmina with basal half reddish, opaque, six black spots in costal cell, some large ones in the subcostal and radial cells, and many small ones scattered over the claval area; apical area sub-fuscous, with numerous fuscous or fuscous-brown spots.

Wings hyaline, the basal two-thirds fuscous, a large basal reddish area streaked with orange, extreme tip of wing pale fuscous; venation for the most part fuscous.

Legs with posterior tibiæ bearing three spines (Pl. iv, fig. 2).

Pygophor yellow-brown, basal portion black; anal tube missing.

♂ Length 12·2 mm., width across eyes 5·4 mm., width of abdomen 5·4 mm., length of tegmen 16 mm., length of posterior tibia 4·8 mm. Closely resembling the female. *Abdomen* ventrally verdigris-green, the lateral margins with black spots, the segmental margins, with the exception of the first, with black markings. *Pygophor* basally black, otherwise verdigris-green. Anal tube missing.

Locality.—Queensland, Chinchilla, January, 1924, 1 ♀ holotype, 1 ♂ allotype, collected by Mr. T. A. Cole.

Types.—Holotype ♀ K55909 and allotype ♂ K55910 in the Australian Museum collection.

Genus DESUDABA *Walker.*

1858. *Desudaba* Walker, List Homopt. Suppl., p. 58. Orthotype *Desudaba psittacus* Walker.

1863. *Metanira* Stal, Stettiner Ent. Zeit., xxiv, p. 236. Logotype by present designation *Metanira thisbe* Stal.

DESUDABA PSITTACUS *Walker.*

1858. *Desudaba psittacus* Walker, List Homopt. Suppl., p. 59. Moreton Bay.

1863. *Metanira thisbe* Stal, Stettiner Ent. Zeit., xxiv, p. 236. Moreton Bay.

1906. *Desudaba psittacus* Kirkaldy, Haw. Sug. Plant. Ass. Bull. i, 9, p. 390. Brisbane.

Hab.—Queensland, Meringa, near Cairns, Nov., 1926, 1 ♀, collected by Mr. G. M. Goldfinch; Gowrie Mt., Dec., 1920, 1 ♂ 1 ♀, collected by Mr. R. Illidge; Bulimba, Brisbane, 1 ♂ 1 ♀, collected by Mr. R. Illidge and identified by Mr. W. E. China; Brisbane, 17th Jan., 1923, 2 ♀, collected by A. Musgrave; Brisbane, 12th Dec., 1925, 1 ♂ 1 ♀, collected by Mr. L. Franzen; Tambourine Mt., 19th Dec., 1925, 1 ♂, collected by A. Musgrave.

New South Wales: Uki, Tweed River, 9th-10th Jan., 1923, 7 ♂ 2 ♀, collected by A. Musgrave; Lismore, 7th Jan., 1923, 6 ♂ 2 ♀, collected by A. Musgrave; Gundamaian, National Park, Port Hacking, Dec., 1925, 3 ♂ 3 ♀, collected by Mr. A. J. Nicholson; same locality, 30th-31st Jan., 1926, 6 ♂ 6 ♀, collected by Messrs. T. G. Campbell and A. Musgrave; National Park, 2nd Jan., 1927, 2 ♀, collected by Mr. G. M. Goldfinch.

Note.—While collecting at Gundamaian, National Park, N.S. Wales, in December, 1925, Mr. A. J. Nicholson, M.Sc., Lecturer in Entomology at the University of Sydney, collected a number of specimens of this leaf-hopper. On Saturday, 30th Jan., 1926, Mr. T. G. Campbell and myself collected about sixteen specimens of the same species on a vine which grew along a wire fence at Gundamaian. Two vines were intertwined on the fence, *Mandevillia suaveolens*, an introduced plant with large white flowers and heavily veined leaves, and *Marsdenia rostrata*, a member of the order Asclepiadeæ. These plants were identified by Mr. Blakely, of the Herbarium, Sydney Botanic Gardens. As the insect was first recorded from Moreton Bay, the range of the species is considerably extended southwards, while a specimen in the Museum collection from Meringa, near Cairns, collected by Mr. G. M. Goldfinch, extends the range northwards.

STUDIES ON AUSTRALIAN BRYOZOA.

No. 5.

A CHECK LIST OF THE MARINE BRYOZOA OF QUEENSLAND.

By

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It is intended that this work be considered only as a list of the marine bryozoa inhabiting the coastal waters of Queensland, the Great Barrier Reef, and the outlying islands. No attempt has been made to record full synonymy, though in some cases where a well-known species has been transferred to another genus a note of the fact has been made for clarity. An effort has been made to give the original reference to each genus and species, a reference to a well-known work possessing a good description and figure, and to the author responsible for the record of the species. For additional references no better work than Miss Jelly's catalogue could be consulted. Species with doubtful localities have been omitted.

In regard to specimens named by Busk as new from the collections of the "Rattlesnake" and altered later in the British Museum catalogue, I have considered it advisable to adhere to the names by which the species have been known since 1852. Changing well-established names leads to much confusion, though it is realized that the law of priority was not instituted to be ignored.

Modern ideas of classification have been adopted as far as considered advisable. The splitting up of the genus *Schizoporella* as Canu and Bassler (1917-20) have done, appears to be based in some cases upon characters of a variable nature. It is fully appreciated that radical changes must take place, but, at the same time, it must be borne in mind that such alterations cannot be hastened unduly, and until more has been done upon the group in question I hesitate to adopt the suggested changes in their entirety.

It was upon the advice of the late Mr. Charles Hedley, F.L.S., Director of the Great Barrier Reef Committee, Queensland, that this work was undertaken. Prior to, and during its formation, I received much valuable advice and encouragement from that gentleman, and for his kindness I wish to express my gratitude.

Phylum MOLLUSCOIDEA.

Class BRYOZOA.

Sub-Class ECTOPROCTA.

Order GYMNOLÆMATA.

Sub-Order CHEILOSTOMATA.

Family ÆTEIDÆ.

ETEA Lamouroux, Nouv. Bull. Sci. Soc. Philomat., iii, 1812, p. 184.

1. *dilatata* Busk, Ann. Mag. Nat. Hist., (2), vii, 1851, p. 85. Pl. ix, fig. 14. Busk, Brit. Mus. Cat.. i. 1852, p. 31, Pl. xv, figs. 2-3.

Family BICELLARIIDÆ.

CORNUCOPINA Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 109.

2. *grandis* Busk, Voy. "Rattlesnake," i, 1852, p. 374 Brit. Mus. Cat., i, 1852, p. 42, Pl. xliv.

BUGULA Oken, Lehrbuch der Naturgeschichte, iii, Zool., i, 1815, p. 89. Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 100.

3. *dentata*. *Acamarchis dentata* Lamouroux, Hist. des Polyp. Corallig. flexibles, 1816, p. 135. MacGillivray *in* McCoy, Prodr. Zool. Victoria, i, dec. viii, 1883, p. 30. Pl. lxxviii, fig. 3. Kirkpatrick, Sci. Proc. Roy. Dublin Soc., (n.s.), vi, 10, 1890, p. 611.

4. *johnstoniæ* Gray *in* E. Dieffenbach's Travels in New Zealand, ii, 1843, p. 292. Busk, Brit. Mus. Cat., i, 1852, p. 43, Pl. xxx. Ortmann, Archiv für Naturg., lvi, i, 1, 1890, p. 24, Pl. 1, fig. 16. Haswell, Proc. Linn. Soc. N.S Wales, v, 1, 1880, p. 37.

STIRPARIELLA *nom. nov.* Harmer Journ. Linn. Soc. Zool., xxxv, 1923, p. 317. *Stirparia* Goldstein, Quart. Journ. Micr. Soc. Victoria, 1, 1880, p. 75.

5. *haddoni* Kirkpatrick, Sci. Proc. Roy. Dublin Soc., (n.s.), vi, 10, 1890, p. 613, Pl. xv, fig. 4.

BEANIA Johnston, Ann. Mag. Nat. Hist., v, 1840, p. 272.

6. *hirtissima var. cylindrica* Hincks, Ann. Mag. Nat. Hist., (5), xvii, 1886, p. 263. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 611.

Family FARCIMINARIIDÆ.

NELLIA Busk, Brit. Mus. Cat., i, 1852, p. 18.

7. *oculata* Busk, Brit. Mus. Cat., i, 1852, p. 18, Pl. xliv, fig. 6; Pl. lxv (bis), fig. 4. *Salicornaria dichotoma* Busk, Voy. "Rattlesnake," i, 1852, p. 367. *Farcimia oculata* Waters, Proc. Zool. Soc., 1913, p. 489, Pl. xlvii, figs. 8-9.

8. *simplex* Busk, Brit. Mus. Cat., i, 1852, p. 19, Pl. lxv, fig. 1; Pl. lxv (bis), fig. 3. *Salicornaria marginata* Busk, Voy. "Rattlesnake," i, 1852, p. 367.

Family FLUSTRIDÆ.

RETIFLUSTRA Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 126.

9. *cribriformis*. *Retepora cornea* Busk, Voy. "Rattlesnake," i, 1852, p. 380. *Carbasea cribriformis* Busk, Brit. Mus. Cat., 1852, p. 51, Pl. lxviii, fig. 1. Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 128.

10. *reticulum*. *Flustra reticulum* Hincks, Ann. Mag. Nat. Hist., (5), x, 1882, p. 163, Pl. vii, fig. 4. Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 129, Pl. xxii, fig. 1a-c. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 611.

SPIRALARIA Busk, Quart. Journ. Micr. Sci., (n.s.), i, 1861, p. 153. Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 125.

11. *denticulata*. *Flustra denticulata* Busk, Voy. "Rattlesnake," i, 1852, p. 380. MacGillivray *in* McCoy, Prodr. Zool. Victoria, i, dec. v, 1880, p. 27, Pl. xlv, fig. 1. MacGillivray, Trans. Proc. Roy. Soc. Victoria, iv, 1860, p. 164.

Family SCRUPOCELLARIIDÆ.

SCRUPOCELLARIA Van Beneden, Nouv. Mem. de l'Academie Royale de Bruxelles, xviii, 1844, p. 44.

12. *clypeata* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 37, Pl. 1, fig. 6.

13. *obtecta* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 37. MacGillivray *in* McCoy, Prodr. Zool. Victoria, ii, dec. xiii, 1886, p. 100, Pl. cxxvi, figs. 4-5.

14. *diadema* Busk, Voy. "Rattlesnake," i, 1852, p. 370. Busk, Brit. Mus. Cat., i, 1852, p. 24, Pl. xxviii, figs. 1-3. Ortmann, Archiv für Naturg., i, 1890, p. 22, Pl. 1, fig. 4.

15. *cervicornis* Busk, Voy. "Rattlesnake," i, 1852, p. 370. Brit. Mus. Cat., i, 1852, p. 24, Pl. xlii. MacGillivray *in* McCoy, Prodr. Zool. Victoria, ii, dec. xiii, 1886, p. 101, Pl. cxxvi, figs. 6-7. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 611.

16. *macandrei* Busk, Brit. Mus. Cat., i, 1852, p. 24, Pl. xxiv, figs. 1-3. "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 23, Pl. xi, fig. 4. Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 37.

TRICELLARIA Flemming, A History of British Animals, 1828, p. 540. Harmer, Journ. Linn. Soc. Zool., xxxv, 1923, p. 353.

17. *cuspidata*. *Cellularia monotrypa* Busk, Voy. "Rattlesnake," i, 1852, p. 368. *Cellularia cuspidata* Busk, Brit. Mus. Cat., i, 1852, p. 19, Pl. xxvii, figs. 1-2. Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 36.

CABEREA Lamouroux, Hist. des Polyp. corallig. flexibles, 1816, p. 128. Levinsen, Morph. Sys. Stud. Cheil. Bryozoa, 1909, p. 134.

18. *grandis* Hincks, Ann. Mag. Nat. Hist., (5), viii, 1881, p. 2, Pl. iii, figs. 4a-b. Waters, Ann. Mag. Nat. Hist., (5), xx, 1887, p. 90. MacGillivray *in* McCoy, Prodr. Zool. Victoria, ii, dec. xiv, p. 137, Pl. 136, fig. 2.

19. *lata* Busk, Voy. "Rattlesnake," i, 1852, p. 378. "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 30, Pl. xi, fig. 3. Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 36.

AMASTIGIA Busk, Brit. Mus. Cat., i, 1852, p. 40. Harmer, Journ. Linn. Soc. Zool., xxxv, 1923, p. 329.

20. *rudis*. *Caberea rudis* Busk, Voy. "Rattlesnake," i, 1852, p. 377. Brit. Mus. Cat., i, 1852, p. 38, Pl. xlvi. Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 36.

Family MEMBRANIPORIDÆ.

ELECTRA Lamouroux, Hist. des Polyp. Corallig. flexibles, 1816, p. 120.

21. *bellula* Hincks, Ann. Mag. Nat. Hist., (5), vii, 1881, p. 149, Pl. viii, fig. 4. *Membranipora cervicornis* Haswell (non Busk, B.M.C., 1854), Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 38. *Membr. haswelli nom. nov.* Hincks, Ann. Mag. Nat. Hist., (5), x, 1882, p. 468.

CALESCHARA MacGillivray *in* McCoy, Prodr. Zool. Victoria, i, dec. v, 1880, p. 45. Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 152.

22. *rosselii*, Audouin, Expl. des planches de M. Savigny, p. 240 (69), Savigny, Zool. Egypt, Pl. x, fig. 11 (*fide* Jelly, 1889). *Membranipora rosselii* Hincks, Brit. Marine Polyzoa, 1880, p. 166, Pl. xxii, fig. 4. Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 38.

TREMOPORA Ortmann, Archiv. für Naturg., lvi, 1, 1890, p. 29.

23. *radicifera var, intermedia*, Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 615, Pl. xvi, figs. 1-2.

CHAPERIA Jullien, Miss. Sci. du Cap Horn, Zool., vi, 1888, Bryozoa, p. 61.

24. *cervicornis*. *Membranipora cervicornis* Busk (non Haswell, 1880), Brit. Mus. Cat., ii, 1854, p. 60, Pl. C, fig. 3. Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 115. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

25. *acanthina*. *Flustra acanthina* Quoy and Gaimard, Voy. de "l'Uranie," 1824, Zool., p. 605, Pl. lxxxix, figs. 1-2. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 617, Pl. xvi, fig. 6.

ACANTHODESIA Canu and Bassler, U.S. Nat. Mus., Bull. 106, 1920. p. 99.

26. *savartii* Audouin, Expl. sommaire des planches de l'Égypte et de la Syrie *in* Savigny's descr. de l'Egypte, Hist. Nat. iii, Paris, 1826, p. 240, Pl. x, fig. 10 (*fide* Canu and Bassler, U.S. Nat. Mus., Bull., 106, 1920, p. 100). Waters, Journ. Linn. Soc., Zool., xxxi, 1909, p. 137, Pl. 11, figs. 8-13.

ADENIFERA Canu and Bassler, U.S. Nat. Mus., Bull. 96, 1917, p. 12.

27. *armata*. *Membranipora armata* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 38, Pl. i, fig. 7. Waters, Proc. Zool. Soc., 1913, p. 486, Pl. lxvii, fig. 10; Pl. lxxi, figs. 5-10.

ELLISINA Norman, Ann. Mag. Nat. Hist., (7), ii, 1903, p. 596.

28. *coronata* Hincks, Ann. Mag. Nat. Hist., (5), vii, 1881, p. 147, Pl. x, fig. 1. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 615.

MAMILLOPORA Smitt, K. Svenska Vetenskaps-Akad. Handl., x, No. 11, p. 33.

29. *simplex*. *Stichoporina simplex* Koschinsky, Paleontographica, xxxii, 1885, p. 64, Pl. vi, figs. 4-7 (*fide* Waters, Ann. Mag. Nat. Hist., (9), iii, 1919, p. 86). Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 623, Pl. xvii, fig. 4.

CUPULARIA Lamouroux, Expos. méthod. des genres de l'ordre des polypiers, 1821 (*fide* Robertson, Univ. Calif. Publ., Zool., iv, 5, 1908, pp. 314 and 319). Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 154.

30. *guineensis* Busk, Brit. Mus. Cat., ii, 1854, p. 98, Pl. cxiv. "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 206, Pl. xiv, fig. 6.

LUNULARIA Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 208.

31. *gibbosa*. *Lunulites gibbosa* Busk, Brit. Mus. Cat., ii, 1854, p. 100, Pl. cxi.

32. *capulus* Busk, Brit. Mus. Cat., ii, 1854, p. 100, Pl. cxii. "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 208, Pl. xiv, fig. 7a. Livingstone, Rec. Austr. Mus., xiv, 3, 1924, p. 198.

SELENARIA Busk, Brit. Mus. Cat., ii, 1854, p. 101.

33. *maculata* Busk, Voy. "Rattlesnake," i, 1852, Pl. 1, figs. 15-16. Brit. Mus. Cat., ii, 1854, p. 101, Pl. cxvii. Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 42.

34. *punctata* Tenison-Woods, Trans. Proc. Roy. Soc. S. Australia, iii, 1880 (1870-80), p. 9, Pl. 11, fig. 8a-c. *Selenaria fenestrata* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 42. MacGillivray, Trans. Proc. Roy. Soc. Victoria, iv, 1895, p. 47, Pl. vii, figs. 8-9.

Family CRIBRILINIDÆ.

PUELLINA Jullien, Bull. Soc. Zool. France, xi, 1886, p. 607. Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 159.

35. *radiata*. *Cribrilina radiata*, Moll, Die Seerinde, aus der Ordnung der Pflanzenthiere, das schönste u. merkwürd Geschecht, mit neuen Arten vermehrt. Wien, 1803, p. 63, Pl. iv, fig. 7 (*fide* Canu and Bassler, U.S. Nat. Mus., Bull. 106, 1920, p. 295). Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

Family STEGANOPORELLIDÆ.

STEGANOPORELLA Smitt, Kongl. Svenska Vetenskaps-Akad. Handl., ii, 4, 1873, p. 15.

36. *lateralis* MacGillivray, Trans. Proc. Roy. Soc. Victoria, iv, 1895, p. 53, Pl. vi, fig. 18. Harmer, Quart. Journ. Micr. Sci., (n.s.), xliii, 2, 1900, p. 242, Pl. xii, fig. 1; Pl. xiii, figs. 19-20 and 27.

37. *haddoni* Harmer, Quart. Journ. Micr. Sci., (n.s.), xlvi, 2, 1900, p. 268, Pl. xii, fig. 11; Pl. xiii, figs. 38-39.

38. *buskii* Harmer, Quart. Journ. Micr. Sci., (n.s.), xlvi, 2, 1900, p. 272, Pl. xii, fig. 13; Pl. xiii, figs. 33-35.

39. *magnilabris* Busk, Brit. Mus. Cat., ii, 1854, p. 62, Pl. lxv, fig. 4. Harmer, Quart. Journ. Micr. Sci., (n.s.), xlvi, 2, 1900, p. 279, Pl. xii, fig. 10; Pl. xiii, figs. 31 and 44-46. *Biflustra crassa* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 38, Pl. i, fig. 8.

40. *alveolata* Harmer, Quart. Journ. Micr. Sci., (n.s.), xlvi, 2, 1900, p. 287, Pl. xii, fig. 12; Pl. xiii, figs. 32, 40-41.

Family THALMOPORELLIDÆ.

THALMOPORELLA Hincks, Ann. Mag. Nat. Hist., (5), xix, 1887, p. 164.

41. *novæ-hollandiæ*. *Vinoularia novæ-hollandiæ* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 41, Pl. iii, fig. 3. Levinsen, Morph. Syst. Stud. Cheil, Bryozoa, 1909, p. 185, Pl. vi a, figs. 3a-f.

42. *rozieri* Audouin, Zool. Egypte, p. 239, Pl. 8, fig. 9 (*fide* Waters, Proc. Linn. Soc. Zool., xxxi, 1909, p. 141, Pl. xv, figs. 12-15). *var. indica* Hincks, Ann. Mag. Nat. Hist., (5), vi, 1880, p. 379, Pl. xvi, fig. 1. *Steganoporella smittii* Hincks, Brit. Marine Polyzoa, 1880, p. 178, Pl. xxiv, figs. 5-6. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

43. *rozieri var. gothica*. *Membranipora gothica* (Rylands MS.) Busk, Quart. Journ. Micr. Sci., iv, 1856, p. 167, Pl. vii, figs. 5-6. Levinsen, Morph. Syst. Stud. Cheil, Bryozoa, 1909, p. 184. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

44. *rozicri var. sparsipuncta* Levinsen, Morph. Syst. Stud. Cheil Bryozoa, 1909, p. 183, Pl. vi b, figs. 3a-b.

Family CHLIDONIIDÆ.

CHLIDONIA Savigny, Zool. Egypt, 1811, Planches, Pl. xiii (name only). d'Orbigny, Paleont. Franc. Terr. crét. Bryozoaires, 1850-52, p. 40.

45. *cordieri* Audouin, Descr. de l'Égypte, Hist. Nat., p. 242, 2nd edit., p. 74; Savigny's Pl. xiii, fig. 3, [1811] (*fide* Waters, Proc. Zool. Soc., 1913, p. 492. Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 8, Pl. xxviii, fig. 11).

Family CELLARIIDÆ.

CELLARIA Ellis and Solander, The Natural History of Many Curious and Uncommon Zoophytes, 1786, p. 18. Harmer, Journ. Linn. Soc., Zool., xxxv, 1923, pp. 301 and 315.

46. *dubia* Busk, "Challenger" Rep. Zool., x, pt. xxx, 1884, p. 91, Pl. xii, fig. 2 and text-fig. 10. *Salicornaria tenuirostris* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 36.

47. *gracilis* Busk, Brit. Mus. Cat., i, 1852, p. 17, Pl. lxiii, fig. 3. *Salicornaria punctata* Busk, Voy. "Rattlesnake," i, 1852, p. 366. Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 93 and text-fig. 13a.

Family CATENICELLIDÆ.

CATENICELLA Blainville, Manuel d'Actin. Zooph., 1834, p. 462.

48. *taurina* Busk, Brit. Mus. Cat., i, 1852, p. 12, Pl. xi, figs. 1-4. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 611.

49. *gibbosa* Busk, Voy. "Rattlesnake," i, 1852, p. 360. Brit. Mus. Cat., i, 1852, p. 12, Pl. vii, figs. 3-4. Not synonymy in list of localities of *C. buskii* by Marcus (Kungl. Sven. Vetenskaps-Akad. Handl., lxi, 5, 1921, pp. 9-10).

VITTATICELLA Maplestone, Trans. Proc. Roy. Soc. Victoria, (n.s.), xiii, 1900, p. 203.

50. *elegans* Busk, Voy. "Rattlesnake," i, 1852, p. 361, Pl. i, fig. 2. Levinsen, Morph. Syst. Stud. Cheil Bryozoa, 1909, p. 255, Pl. xxi, fig. 2a; Pl. xiii, figs. 3a-b. Busk, Brit. Mus. Cat., i, 1852, p. 10, Pl. ix. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 611.

Family EUTHYROIDÆ.

EUTHYROIDES Harmer, Quart. Journ. Micr. Sci., (n.s.), xlvi, 2, 1902, p. 280.

51. *episcopalis* Busk, Brit. Mus. Cat., i, 1852, p. 52, Pl. iv, fig. 3; Pl. xlviii, figs. 1-2. MacGillivray *in* McCoy, Prodr. Zool. Victoria, i, dec. v, 1880, p. 28, Pl. xlv, fig. 2. Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 37.

Family EUTHYRIDÆ.

EUTHYRIS Hincks, Ann. Mag. Nat. Hist., (5), x, 1882, p. 164.

52. *obtecta* Hincks, Ann, Mag. Nat. Hist., (5), x, 1882, p. 165, Pl. vii, fig. 3. Levinsen, Morph. Syst. Stud. Cheil, Bryozoa, 1909, p. 272, Pl. xv, figs. 2a-f.

Family HIPPOTHOIDÆ.

TRYPOSTEGA Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 280.

53. *venusta.* *Lepralia venusta* Norman, Ann. Mag. Nat. Hist., (3), xiii, 1864, p. 84, Pl. x, figs. 2-3. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612. Waters, Proc. Zool. Soc., 1913, p. 506.

CHORIZOPORA Hincks, Ann. Mag. Nat. Hist., (5), iii, 1879, p. 156. Hincks, Brit. Marine Polyzoa, 1880, p. 222.

54. *vittata.* *Lepralia vittata* MacGillivray, Trans. Proc. Roy. Soc. Victoria, ix, 2, 1868 (1869), p. 132. MacGillivray *in* McCoy, Prodr. Zool. Victoria, i, dec. iv, 1879, p. 25, Pl. xxxvi, fig. 1. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

55. *brongniartii var. spinosa* Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, pt. 10, 1890, p. 615, Pl. xvi, fig. 4.

Family ADEONIDÆ.

ADEONELLA Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 183.

56. *platalea* Busk, Brit. Mus. Cat., ii, 1854, p. 90, Pl. cv, figs. 1-3; Pl. cviii, fig. 4. Waters, Proc. Zool. Soc., 1913, p. 529, Pl. lxxiii. *Eschara hexagonalis* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 41, Pl. iii, figs. 1-2.

57. *pectinata* Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 189, text-fig. 58.

58. *intricaria* Busk, "Challenger" Rep., Zool, x, pt. xxx, 1884, p. 185, Pl. xxi, fig. 2, and text-figs. 51-53. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

RADULINA Meissner, Denksch. med.-naturw. Ges., Jena, viii, 1903, p. 731.

59. *semoni* Meissner, Denksch, med.-naturw. Ges., Jena, viii, 1903, p. 731, Pl. lxvi, figs. 1-4.

Family RETEPORIDÆ.

RETEPORA Imperato, Dell 'historia naturale, libre xxviii, Naples, 1599 (*fide* Canu and Bassler, U.S. Nat. Mus., Bull. 106, 1920, p. 500, reference in part).

60. *carinata* MacGillivray, Trans. Proc. Roy. Soc. Victoria, xx, 1884, p. 110. MacGillivray *in* McCoy, Prodr. Zool. Victoria, i, dec. x, 1885, p. 25, Pl. 97, fig. 7. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, pt. x, 1890, p. 612.

61. *monilifera var. munita* Hincks, Ann. Mag. Nat. Hist., (5), 1, 1878, p. 361. MacGillivray *in* McCoy, Prodr. Zool. Victoria, i, dec. x, 1885, p. 22, Pl. xcvi, figs. 4-8. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

62. *monilifera var. munita form acutirostris* MacGillivray, Trans. Proc. Roy. Soc. Vict., xx, 1884, p. 109, Pl. i, fig. 4; Pl. iii, fig. 3. Meissner, Denksch, med.-naturw. Ges., Jena, Semon, Forchungr. Austr., v, viii, 1903, p. 731.

63. *monilifera var. umbonata* MacGillivray, Trans. Proc. Roy. Soc. Vict., xx, 1884, p. 107. MacGillivray *in* McCoy, Prodr. Zool. Victoria, i, dec. x, 1885, p. 23, Pl. xcvii, figs. 1-3. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

64. *hirsuta* Busk, "Challenger" Rep., Zool. x, pt. xxx, 1884, p. 119, Pl. xxvi, fig. 4. Waters, Journ. Linn. Soc. Zool., xxxi, 1909, p. 175, Pl. xviii, figs. 24-26.

65. *tubulata* Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 121, Pl. xxviii, fig. 2 and text-fig. 32.

66. *phœnicea* Busk, Brit. Mus. Cat., ii, 1854, p. 94, Pl. cxxi, figs. 1-2. Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 124.

67. *græffei* Kirchenpauer, Mus. Godeffroy Cat., iv, 1868 (1869), p. xxx. Marcus, Kungl. Svenska Vetenskap. Handl., 61, No. 5, 1921, p. 15. *Retepora producta* Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 108, Pl. xxv, fig. 7.

68. *cellulosa* Smitt, Kritisk. Fört. Öfv. Skandin. Hafs-Bryozoer, 1867, p. 35 (*fide* Jelly, 1889). Busk, Brit. Mus. Cat., ii, 1854, p. 93. Pl. cxxi, figs. 3-8; Pl. cxxiii, figs. 5-6. Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 41.

Rhynchozoon *nom. nov.* Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 294. *Rhynchopora* Hincks, Brit. Marine Polyzoa, i, 1880, p. 385.

69. *longirostre* Hincks, Ann. Mag. Nat. Hist., (5), viii, 1881, p. 125, MacGillivray *in* McCoy, Prodr. Zool. Victoria, ii, dec. xx, 1890, p. 356, Pl. cxcvi, figs. 11-14.

Family TUBUCELLARIIDÆ.

Tubucellaria d'Orbigny, Paleont. Franc. Terr. crét., v, 1850-52. p. 335.

70. *cereoides var. chuakensis* Waters, Journ Linn. Soc. Zool., xxx, 1907, p. 130, Pl. xv, figs. 10-13 and 18-19; Pl. xvi, figs. 20-25. *Tubucellaria fusiformis* Busk (non d'Orbigny), "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 100.

Family ESCHARELLIDÆ.

Lepralia Johnston, A History of the British Zoophytes, 1st ed., 1838, p. 277.

71. *mucronata var. celleporoides*. *Lepralia celleporoides* Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 142, Pl. xvii, fig. 4. Livingstone, Rec. Austr. Mus., xv, 2, 1926, p. 167. ? *Lepralia mucronata* Kirkpatrick (nec. Smitt), Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

72. (? *L.*) *chartacea* Lamarck, Hist. Nat. Anim. sans Vert., ii, 1816, p. 175. Lamouroux, Encyc. Méthodique, Zooph., ii, 1824, p. 374. MacGillivray, Trans. Proc. Roy. Soc. Victoria, iv, 2, 1859 (1860), p. 167, Pl. iii, figs. 1-3.

73. *lonchæa* Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 146, text-fig. 43. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

74. *dorsipora* Busk; Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612 (apparently meant for *Lepralia dorsiporosa*, see *Petralia dorsiporosa,* No. 134 of this list).

75. *depressa* Busk, Brit. Mus. Cat., ii, 1854, p. 75, Pl. xci, figs. 3-4. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

76. *filamentosa* Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 619, Pl. xvi, fig. 5.

77. (*L.* ?) *occulosa* Busk, "Challenger" Rep., Zool. x, pt. xxx, 1884, p. 150, Pl. xxi, fig. 8. Waters, Journ. Linn. Soc. Zool., xxxi, 1909, p. 152, Pl. xiii, fig. 15; Pl. xiv, figs. 1-9 and 13.

78. *irregularis* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 39, Pl. ii, fig. 1.

79. *pertusa* Esper, Pflanz. Cellepora, p. 149, t. x, fig. 2 (*fide* Busk, Brit. Mus. Cat., ii, 1854, p. 80, Pl. lxxviii; Pl. lxxix, figs. 1-2). Hincks, Brit. Marine Polyzoa, 1880, p. 305, Pl. xliii, figs. 4-5. Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 39.

80. *lateralis* MacGillivray, Trans. Proc. Roy. Soc. Victoria, (n.s.), iii, 1891, p. 80, Pl. x, fig. 3. Livingstone, Rec. Austr. Museum, xv, 1, 1926, p. 94.

81. *tuberculata var. avicularia* Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 93, Pl. v, figs. 1-3.

SCHIZOPORELLA Hincks, Brit. Marine Polyzoa, 1880, p. 237.

82. *ventricosa*. *Onchopora ventricosa* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 36, Pl. i, fig. 3.

83. *immersa*. *Onchopora immersa* Haswell, Proc. Linn. Soc. N.S. Wales, v, pt. 1, 1880, p. 36, Pl. i, figs. 4-5.

84. *granulosa. Onchopora granulosa* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 36.

85. *incrassata* Hincks, Ann. Mag. Nat. Hist., (5), ix, 1882, p. 124, Pl. v, figs. 1-1a. Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 83.

86. *viridis var. thornelyi* Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 84, Pl. viii, figs. 8-9.

87. *australis* Haswell (non Tenison-Woods, 1878), Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 41, Pl. ii, figs. 7-8. Harmer, Quart. Journ. Micr. Sci., (n.s.), 46, 2, p. 303, Pl. xvii, fig. 47.

88. (? *S.*) *fenestrata* Smitt, Kongl. Svenska Vetenskaps-Akad. Handl., 1872-73, ii, p. 47. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

89. *concinna* Hincks, Ann. Mag. Nat. Hist., (6), vii, 1891, p. 289, Pl. vi, fig. 2.

90. *spinifera var.* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 39. Johnston, A History of the British Zoophytes, 2nd ed., 1847, p. 324, Pl. lvii, fig. 6 (type). Hincks, Brit. Marine Polyzoa, 1880, p. 241, Pl. xxxv, figs. 6-8 (type).

91. *assimilis,* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 39.

92. *nivea* Busk, "Challenger" Rep., Zool., x, pt xxx, 1884, p. 163, Pl. xvii, fig. 1. Waters, Proc. Zool. Soc., 1913, p. 502, Pl. lxx, figs. 1-3 and 7-9; Pl. lxxiii, fig. 16 and text-fig. 80. Livingstone, Rec. Austr. Museum, xv, 1, 1926, p. 85.

93. *unicornis* Johnston, A History of the British Zoophytes, 2nd ed., 1847, p. 320, Pl. lvii, fig. 1. Waters, Journ. Linn. Soc. Zool., xxxi, 1909, p. 143, Pl. xii, figs. 12-13.

PARMULARIA (Busk MS.) MacGillivray, Proc. Roy. Soc. Vict., xxiii, 1887, p. 211.

94. *obliqua* MacGillivray, Trans. Proc. Roy. Soc. Vict., ix, 2, 1868, p. 137. Livingstone, Rec. Austr. Mus., xiv, 3, 1924, p. 190, Pl. xxiii, figs. 1-2; Pl. xxv, fig. 1; Pl. xxvi and fig. 1.

95. *macneilli,* Livingstone, Rec. Austr. Mus., xiv, 3, 1924, p. 194, Pl. xxiv, figs. 1-2; Pl. xxv, fig. 2.

96. *integer,* Livingstone, Rec. Austr. Mus., xiv, 3, 1924, p. 195, Pl. xxiii, fig. 3.

97. *quadlingi* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 39, Pl. ii, figs. 1-2. Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 85, Pl. vi, figs. 1-2.

ESCHAROIDES Milne Edwards; Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 317. Hincks (Brit. Mar. Poly., 1880, p. 336) maintains that Smitt is the author of the genus yet admits that the "name originated with Milne Edwards."

98. *discus* Kirkpatrick, Ann. Mag. Nat. Hist., (6), i, 1888, p. 82, Pl. ix, figs. 6a-b. Livingstone, Australian Zoologist, iv, 4, 1926, p. 247.

99. *sauroglossa,* Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 319, Pl. xvii, figs. 6a-f in text (5a-f in expl. of plates). Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 96.

HASWELLIA Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 171.

100. *australiensis*. *Myriozöum australiense* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 43, Pl. iii, figs. 9-11. Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 172, Pl. xxiv, fig. 9.

MICROPORELLA Hincks, Brit. Marine Polyzoa, 1880, p. 204.

101. *malusii* Audouin, Expl. to Savigny's plates, i, p. 239; Savigny, Egypte, Pl. viii, fig. 8 (*fide* Hincks, Brit. Marine Polyzoa, 1880, p. 211, Pl. xxviii, figs. 9-11; Pl. xxix, fig. 12). Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

102. *coronata* Audouin and Savigny, Descr. de l'Égypte, p. 239, Pl. ix, fig. 6 (*fide* Waters, Journ. Linn. Soc. Zool., xxxi, 1909, p. 142, Pl. 12, figs. 6-9). *Lepralia lunifera* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, p. 40.

103. (? *M.*) *lichenoides*. *Eschara lichenoides* Milne Edwards, sur les Eschares, p. 31, Pl. ii, fig. 3 (*fide* Busk, Brit. Mus. Cat., ii, 1854, p. 90, Pl. cvi, figs. 1-3).

INVERSIULA Jullien, Sci. Miss. du Cap Horn, vi, 1888, Zool., Bryozoa, p. 44.

104. *inversa*. *Porina inversa* Waters, Ann. Mag. Nat. Hist., (5), xx, 1887, p. 190, Pl. iv, fig. 23; Pl. v, fig. 5. *Microporella inversa* Waters, Ann. Mag. Nat. Hist., (6), iv, 1889, p. 6, Pl. 1, figs. 11-12. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, pt. x, 1890, p. 612.

HIPPOPORINA Neviani, Bryozoi, fossili della Forn. Monte Mario presso Roma, Paleont. Italica, 1895, p. 107.

105. *porcellana var. normani* Livingstone, Rec. Austr. Museum, xv, No. 1, 1926, p. 92, Pl. viii, fig. 1.

ARTHROPOMA Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 332.

106. *cecilii.* *Schizoporella cecilii* Audouin, Zool. Egypte, p. 66 (239), Pl. viii, fig. 3 (*fide* Waters, Proc. Zool. Soc., 1913, p. 508). Hincks, Brit. Marine Polyzoa, 1880, p. 269, Pl. xliii, fig. 6. *Lepralia gandyi* Haswell, Proc. Linn. Soc. N.S. Wales, v, pt. i, 1880, p. 40.

SCHIZOMAVELLA Canu and Bassler, U.S. Nat. Mus., Bull. 96, 1917, p. 40.

107. *auriculata.* *Schizoporella auriculata* Hassal, Ann. Mag. Nat. Hist., ix, 1842, p. 411. Hincks, Brit. Marine Polyzoa, 1880, p. 260, Pl. xxix, figs. 3-9. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, pp. 612 and 617.

108. *montferrandi.* *Lepralia montferrandi* Audouin and Savigny, Descr. de l'Égypte Hist. Nat., i, p. 240, Pl. ix, fig. 14 (*fide* Waters, Journ. Linn. Soc. Zool., xxxi, 1909, p. 171, Pl. xvii, figs. 15-18).

109. *Lepralia mortoni* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 40.

HIPPOPODINA Levinsen, Morph. Syst. Stud. Cheil. Bryozoa, 1909, p. 353.

110. *feegeensis.* *Lepralia feegeensis* Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 144, Pl. xxii, fig. 9. Waters, Proc. Zool. Soc., 1913, p. 514, Pl. lxx, figs. 21-22. Livingstone, Rec. Austr. Mus., xv, 1, p 94.

Family CONESCHARELLINIDÆ.

CONESCHARELLINA d'Orbigny, Paleont. Franc. Terr. Crét., v, 1850-52, p. 446.

111. *crassa* Tenison Woods, Trans. Proc. Roy. Soc. S. Australia, iii, 1880 (1879-80), p. 5, Pl. 1, figs. 1a-c. *Bipora crassa* Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, pp. 612 and 622, Pl. xvii, fig. 5. Livingstone, Rec. Austr. Mus., xiv, 4, 1925, p. 301, Pl. xlvi and text-fig. 1.

112. *depressa* Haswell, Proc. Linn. Soc. N.S. Wales, v, pt. i, 1880, p. 41, Pl. iii, fig. 4. Livingstone, Rec. Austr. Mus., xiv, 3, 1924, p. 212.

113. *angulopora* Tenison Woods, Trans. Proc. Roy. Soc. S. Australia, iii, 1880 (1879-80), p. 7, Pl. 1, figs. 3a-c. *Conescharellina conica* Haswell, Proc. Linn. Soc. N.S. Wales, v, pt. i, 1880, p. 42, Pl. iii, figs. 7-8. Livingstone, Rec. Austr. Mus., xiv, 3, 1924, p. 205.

BIPORA Whitelegge, Proc. Linn. Soc. N.S. Wales, (2), ii, 1887, p. 340.

114. *umbonata* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 41, Pl. ii, figs. 5-6. Livingstone, Rec. Austr. Mus., xiv, 3, 1924, p. 209. Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 98, Pl. v, figs. 4-5.

Family SMITTINIDÆ.

SMITTINA Norman, Ann. Mag. Nat. Hist., (7), xii, 1903, p. 120.

115. *trispinosa var. spathulata. Smittia reticulata var. spathulata* MacGillivray, Trans. Proc. Roy. Soc. Vict., xix, 1882, p. 135, Pl. iii, fig. 14. *Smittia spathulata* Waters, Journ. Linn. Soc. Zool., xxxi, 1909, p. 156. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 619, Pl. xvii, fig. 1.

116. *levis* Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 620, Pl. xvi, fig. 8.

117. *nitida* Verrill, American Journ. Sci., ix, 1875, p. 415, Pl. vii, fig. 3. Waters, Journ. Linn. Soc. Zool., xxxi, 1909, p. 173, Pl. xvii, figs. 19-20. Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 88.

118. *trispinosa* Johnston, Edin. Phil. Journ., xiii, p. 322. Hincks, Brit. Marine Polyzoa, 1880, p. 353, Pl. lxix, figs. 1-8. Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 88.

119. *rostriformis* Kirkpatrick, Ann. Mag. Nat. Hist., (6), i, 1888, p. 80, Pl. viii, fig. 7. Ann. Mag. Nat. Hist., (6), v, 1890, p. 21. Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 87.

PORELLA Gray, List of British Animals in the British Museum, 1848, pp. 127 and 148.

120. *areolata. Lepralia occulosa var. areolata* Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 618, Pl. xvi, fig. 7. Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 91, Pl. viii, figs. 2-4.

121. *fissurata* Ortmann, Archiv für Naturg., lvi, 1, 1890, p. 41, Pl. iii, fig. 14. Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 92, Pl. viii, figs. 5-7.

PHYLACTELLA Hincks, Ann. Mag. Nat. Hist., (5), iii, 1879, p. 161.

122. *paradicei* Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 89, Pl. vii, fig. 1 and text-fig. 1.

Family CELLEPORIDÆ.

CELLEPORA Linné, Syst. Natur., edit. xii, i, 2, 1767, p. 1285.

123. (*C.* ?) *granulosa* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 40.

124. *fossa* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 42, Pl. iii, figs. 5-6. MacGillivray, Trans. Proc. Roy. Soc. Victoria, iv, 1895, p. 108, Pl. xiv, figs 8-10.

125. *lævis* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 40, Pl. ii, figs. 3-4.

126. *pumicosa* Linné, Syst. Natur., edit. xii, i, 2, 1767, p. 1286. Waters, Journ. Linn. Soc. Zool., xxviii, 1900, p. 95, Pl. xii, figs. 15-16. Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 40.

Family HOLOPORELLIDÆ.

HOLOPORELLA Waters, Journ. Linn. Soc. Zool., xxxi, 1909, p. 159.

127. *fusca* Busk, Brit. Mus. Cat., ii, 1854, p. 88, Pl. cxix, fig. 2; Pl, cxx, fig. 6. MacGillivray *in* McCoy, Prodr. Zool. Victoria, dec. xvii, 1888, p. 249, Pl. 167, fig. 2. Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 40.

128. *pigmentaria* Waters, Journ. Linn. Soc. Zool., xxxi, 1909, p. 163, Pl. xv, figs. 16-19; Pl. xvi, figs. 9-16; Pl. xvii, figs. 22-23. Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 97.

129. *aperta* Hincks, Ann. Mag. Nat. Hist., (5), ix, 1882, p. 126, Pl. v, fig. 3. Waters, Journ. Linn. Soc. Zool., xxxi, 1909, p. 161, Pl. xviii, figs. 20-23. Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 97.

130. *discoidea* Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 197, Pl. xxx, fig. 8; Pl. xxxv, fig. 1.

131. *discoidea var. frutetosa* Kirkpatrick, Sci. Proc. Roy. Dub. Soc., vi, 10, 1890, p. 621, Pl. xvii, fig. 3.

132. *tridenticulata* Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 198, Pl. xxix, fig. 3; Pl. xxxv, fig. 7.

Family PETRALIIDÆ.

PETRALIA MacGillivray, Trans. Proc. Roy. Soc. Victoria, ix, 2, 1868, p. 141.

133. *japonica* Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 143, Pl. xvii, fig. 5. Levinsen, Morph. Syst. Stud. Cheil, Bryozoa, 1909, p. 352, Pl. xviii, figs. 5a-b. Livingstone, Rec. Austr. Mus., xiv, 3, 1924, p. 196.

134. *dorsiporosa* Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 143, Pl. xviii, fig. 4. Harmer, Quart. Journ. Micr. Sci., (n.s.), xlvi, 2, p. 299, Pl. xvii, fig. 45.

135. *magnifica* Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 158, Pl. xviii, fig. 3. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

136. *bisinuata* Smitt, Kongl. Svenska Vetenskaps-Akad. Handl., 1872-1873, p. 57. *Mucronella bisinuata* Busk, "Challenger" Rep., Zool., x, pt. xxx, 1884, p. 157, Pl. xix, fig. 5. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

137. *vultur var. serrata* Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 95, Pl. vi, figs. 7-10.

138. *vultur. var. bennetti* Livingstone, Rec. Austr. Mus., xv, 1, 1926, p. 96, Pl. vi, figs. 3-6.

Order GYMNOLÆMATA.

Sub-Order CTENOSTOMATA.

Family VESCICULARIIDÆ.

VESCICULARIA J. V. Thompson, Zool. Res., Mem. v. 1830, p. 97. Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 61.

139. *papuensis* Busk, "Challenger" Rep., Zool., xvii, pt. 1, 1886, p. 36, Pl. viii, figs. 1-1c. Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 61, Pl. vi, figs. 1-4.

AMATHIA Lamouroux, Nouv. Bull. Sci. Soc. Philomat., Paris, iii, 1812, p. 184.

140. *convoluta* Lamouroux, Hist. Polyp. Corallig. flexibles, 1816, p. 160. Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 64, Pl. v, figs. 1-5.

141. *tortuosa* Tenison Woods (non Busk), Proc. Roy. Soc. Vict., xvi, 1880, p. 89, fig. 6. *Amathia connexa* Busk, "Challenger" Rep., Zool., xvii, pt. 1, 1886, p. 38, Pl. 6, fig. 3.

142. ? *semispiralis* Kirchenpauer, Cat. Mus. Godeffroy, iv, 1868 (1869), p. 33. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., vi, pt. x, (n.s.), 1890, p. 612.

Family NOLELLIDÆ.

NOLELLA P. H. Gosse, Ann. Mag. Nat. Hist., (2), xvi, 1855, p. 35.

143. *papuensis*. *Cylindrœcium papuense* Busk, "Challenger" Rep., Zool., xvii, pt. 1, 1886, p. 38, Pl. viii, fig. 2. Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 53, Pl. iv, figs. 10-20.

Family ALCYONIDIIDÆ.

ALCYONIDIUM Lamouroux, Ann. Mus. Hist. Nat., Paris, xx, 1813, p. 285.

144. *polyoum* Hassal, Ann. Mag. Nat. Hist., vii, 1841, p. 484. Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 37, Pl. iii, fig. 1.

Family BUSKIIDÆ.

BUSKIA Alder, Trans. Tyneside Nat. Field Club, iii, 2, 1856, p. 156.

145. *setigera* Hincks, Journ. Linn. Soc. Zool., xxi, 1887, p. 127, Pl. xii, figs. 9-13. Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 87, Pl. v, figs. 8-10.

Order GYMNOLÆMATA.

Sub-Order CYCLOSTOMATA.

Family CRISIIDÆ.

CRISIA Lamouroux, Nouv. Bull. Sci. Soc. Philomat., Paris, iii, 1812, p. 183.

146. *denticulata* Lamarck, Hist. Nat. des Anim. sans Vert., ii, 1816, p. 137. Waters, Journ. Linn. Soc. Zool., xxxi, 1910, p. 232. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 612.

147. *geniculata* Milne Edwards, Ann. Sci. Nat. Zool., (2), ix, 1838, p. 197, Pl. vi, figs. 1-1c. Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 106, Pl. viii, fig. 12.

148. *terræ-reginæ* Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 35, Pl. 1, fig. 1.

149. *elongata* Milne Edwards, Ann. Sci. Nat. Zool., (2), ix, 1838, p. 203, Pl. vii, fig. 2. Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 96, Pl. viii, figs. 1-8.

Family ENTALOPHORIDÆ.

ENTALOPHORA Lamouroux, Exp. Méthod. des. Gen. de l'Order des Polyp., 1821, p. 81.

150. *probiscidea* Milne Edwards, Ann. Sci. Nat., (2), ix, 1838, p. 219, Pl. xii, fig. 2. Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 108, Pl. x, fig. 12.

151. *delicatula* Busk, Brit. Mus. Cat., iii, 1875, p. 20, Pl. 6b, fig. 3. Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 110, Pl. x, fig. 11.

152. *intricaria* Busk, Brit. Mus. Cat., iii, 1875, p. 22, Pl. x, figs. 1-4. Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 112, Pl. x, figs. 13-14.

153. *australis var.* ? Busk, Voy. "Rattlesnake," i, 1852, p. 350 (type). Busk, Brit. Mus. Cat., iii, 1875, p. 21, Pl. xvii a, left figure. Haswell, Proc. Linn. Soc. N.S. Wales, v, pt. i, 1880, p. 35 (the var. ?).

154. *fragilis* Haswell, Proc. Linn. Soc. N.S. Wales, v, pt. i, 1880, p. 35, Pl. 1, fig. 2. Waters, Ann. Mag. Nat. Hist., (5), xx, 1887, p. 259.

155. *clavæformis* Busk, Brit. Mus. Cat., iii, 1875, p. 22, Pl. xiv. Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 36.

Family TUBULIPORIDÆ.

TUBULIPORA Lamarck, Hist. Nat. des Anim. sans Vert., ed. i, ii, 1816, p. 161.

156. ? *pulcherrima*. ? *Idmonea milneana* Haswell (non d'Orb), Proc. Linn. Soc. N.S. Wales, v, pt. i, 1880, p. 35. Kirkpatrick, Ann. Mag. Nat. Hist., (6), v, 1890, p. 22, Pl. iv, figs. 6-6b. Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 129, Pl. ix, figs. 1-5.

157. *eboracensis* Busk, "Challenger" Rep., Zool., xvii, pt. 1, 1886, p. 12, Pl. iii, fig. 4.

FILISPARSA d'Orbigny, Pal. Franc. Terr. Crét., v, 1850-52, p. 814.

158. *tubulosa*. *Hornera violacea var. tubulosa* Busk, Brit. Mus. Cat., iii, 1875, p. 19, Pl. xviii, fig. 4. Waters, Journ. Linn. Soc. Zool., xxxi, 1910, p. 235, Pl. xxv, figs. 16-17.

CRISINA d'Orbigny, Prodr. Pal. Stratigr., ii, 1850, p. 265 (*nom. nud.*); Pal. Franc. Terr. Crét., v, 1850-52, pp. 912 and 728.

159. *radians* Lamarck, Hist. Nat. des Anim. sans Vert., ed. i, ii, 1816, p. 183. Harmer, "Siboga" Exped., Polyzoa, i, 1915, p. 139, Pl. x, figs. 6-8.

TERVIA Jullien, Bull. Soc. Zool. France, vii, 1883, p. 500.

160. *jellyæ*. *Idmonea irregularia* Haswell (non Meneghini), Proc. Linn. Soc. N.S. Wales, v, pt. i, 1880, p. 35. Harmer, "Siboga" Exped., Polyzoa, i, 1915, p. 143, Pl. xi, figs. 1-3.

161. (? *T.*) *marionensis* Busk, Brit. Mus. Cat., iii, 1875, p. 13, Pl. xiii, figs. 3-5; Pl. vii, figs. 7-8. Haswell, Proc. Linn. Soc. N.S. Wales, v, pt. i, 1880, p. 35.

Family HORNERIDÆ.

HORNERA Lamouroux, Expos. Méthodique des Gen. de l'Ordre des Polypiers, 1821, p. 41.

162. *cæspitosa* Busk, Brit. Mus. Cat., iii, 1875, p. 17, Pl. xv, figs. 1-3. Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 149, Pl. xi, fig. 13.

RETIHORNERA Kirchenpauer, Cat. Mus. Godeffroy, iv, Hamburg, 1869, p. xxix.

163. *foliacea* MacGillivray, Trans. Proc. Roy. Soc. Vict., ix, 2, 1868 (1869), p. 142. Haswell, Proc. Linn. Soc. N.S. Wales, v, 1, 1880, p. 36.

Family CYTISIDÆ.

SUPERCYSTIS d'Orbigny, Pal. Franc. Terr. Crét., v, 1854, p. 1060.

164. *digitata* Busk, Brit. Mus. Cat., iii, 1875, p. 37, Pl. xxxiii, fig. 1.

Family LICHENOPORIDÆ.

LICHENOPORA Defrance, Dict. Sci. Nat., xxvi, 1823, p. 256.

165. *radiata* Audouin, Egypt, Zool. Expl., p. 235, Pl. vi, fig. 3 (*fide* Hincks, Brit. Marine Polyzoa, 1880, p. 476, Pl. lxviii, figs. 9-10. Kirkpatrick, Sci. Proc. Roy. Dub. Soc., vi, 10, 1890, p. 612).

166. *novæ-zelandiæ* Busk, Brit. Mus. Cat., iii, 1875, p. 32, Pl. xxx, fig. 2. Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 155, Pl. xii, figs. 6-11.

167. *buskii* Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 161, Pl. xii, figs. 4-5.

Sub-Class ENDOPROCTA.

Family PEDICELLINIDÆ.

BARENTSIA Hincks, Ann. Mag. Nat. Hist., (5), vi, 1880, p. 285.

168. *laxa* Kirkpatrick, Sci. Proc. Roy. Dub. Soc., (n.s.), vi, 10, 1890, p. 624, Pl. xvii, fig. 6. Harmer, "Siboga" Exped., Mon. xxviii, Polyzoa, i, 1915, p. 32, Pl. ii, figs. 10-11.

ON *ENHYDRUS FROGGATTI* MACLEAY.

By

Georg Ochs, Frankfurt a.M.

(Figure 1.)

The description of the above-mentioned species was given by William Macleay in his paper on "The Insects of the Fly River[1]" as follows:

"This species differs from *E. albertisi* in being much smaller, in being less nitid but more of a bronzy hue, in having the scutellum much smaller, and in having the elytra much more distinctly marked with opaque striae.

"Length seven lines."

Régimbart[2] in his "Essai Monographique de la famille des Gyrinidae" (2e Supplement) cited this description in original and joined to it the following remark:

"J'avoue que cette description, que je reproduis en entier, ne me donne aucune idée de ce que peut être cet insecte. Peut-être s'agit-il de *Macrogyrus blanchardi* Régimb., que est en effet beaucoup plus petit et marqué plus distinctement de stries opaques."

Indeed the short description given by the author does not allow one to identify the species with any certainty, and, as I had some doubts as to the correctness of Mr. Régimbart's interpretation, I addressed myself to the Australian Museum, Sydney, where the type is preserved, in order to get additional information.

Unfortunately there are no paratypes of this species, and according to the rules of the Trustees the unique type was not allowed to be sent out. I must, however, recognize that the authorities of the Australian Museum did their best to assist me in my researches, and I am especially obliged to Mr. A. Musgrave for an extensive description of the specimen in question, and additional indications, which were accompanied by an instructive figure, which is reproduced here (Fig. 1).

The information received allows me to draw up the following description of *Macrogyrus* (*Enhydrus*) *froggatti* W. Macleay:

Length 12·9 mm. (taken in total), width 6·4 mm. Oval, somewhat elongate; upper surface of body dark green with coppery and purplish reflections, the margins of the thorax coppery; the

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[1] Macleay—Proc. Linn. Soc. New South Wales, (2) I, 1886, p. 141.

[2] Régimbart—Ann. Soc. Entom. France, lx, 1891, p. 669.

undersurface of the body uniformly reddish-black, the hairs on the mouth-parts, legs and end of abdomen, yellowish. The upper surface is finely alutaceous, with round meshes in the head and pronotum, but on the elytra the meshes are transverse. Head impunctate with irregularly arranged striae. Thorax glabrous, marked with striae, but these appear to be more minute than those in the head. Elytra with eight longitudinal striae, the innermost one near the suture being barely apparent, the others becoming deeper and wider on nearing the margin, and are coppery when examined with a lens (under higher power they are alutaceous with round meshes). Each elytron terminates in two acuminate processes, while a similar process is present at the end of the lateral margin a little anterior to the terminal ones. Last abdominal segment projects beyond the ends of the elytra and is covered with yellow hairs. Abdomen, legs and antennae are reddish-black, the lateral margins of the hind coxae concave. The anterior femora are of the same type as in *M. blanchardi* Rég. In comparison to

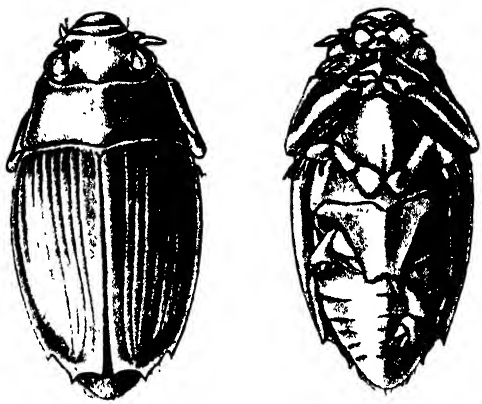

Fig. 1.—*Enhydrus froggatti* Macleay.

M. australis and *M. albertisi* the tiny transverse striolæ are longer and more numerous in *E. froggatti*, and moreover they are placed across the longitudinal striae of the elytra; the fine striae in *M. australis* and *M. albertisi*, on the other hand, appear to be angular.

It results that *Enhydrus froggatti* W. Macleay is a Macrogyrus belonging to the group of *M. blanchardi* Rég., from which it differs, however, chiefly by the acuminate processes at the tip of elytra and by having eight longitudinal striae instead of three-four in *M. blanchardi*.

There is more affinity between *M. froggatti* and *M. sexangularis* Rég[3]., which was collected by Loria during September to December,

[3] Régimbart—Ann. Soc. Entom. France, lxxvi, 1907, p. 156.

1892, at Paumomu River in the south-western district of New Guinea.

The original type of the latter exists probably in Mr. Régimbart's collection, which is now in the Paris Museum; the Museo Civico at Genoa possesses only a single female specimen, which was placed in a series of *M. blanchardi* Rég. Through the kindness of Prof. Gestro, the Director of the Museo Civico, this specimen was sent to me for examination, and I found it identical with the description of *M. froggatti* in all essential characters, with the one exception that there are only four-five longitudinal striæ on the elytra of *M. sexangularis,* while they are to the number of seven-eight in *M. froggatti.* As I have not seen the type of the latter itself, it might be possible that there exist still other distinctions. It seems, however, that the two are conspecific, and that the above-mentioned difference between *M. froggatti* and *M. sexangularis* is only a varietal one.

The paratype of *M. sexangularis* from the Museum at Genoa, which I examined, measured 13 mm. in length (ano excepto); it was a dark-coloured specimen and appeared less nitid than *M. blanchardi.* Compared with the latter, there are moreover the following differences: Head more elongate and more distinctly bordered in front of the eyes. Pronotum less sinuate basally and anteriorly. Elytra with five longitudinal striae, four of which are distinct, the fifth being scarcely apparent posteriorly; they join posteriorly two and three, four and five in *sexangularis* (one and two, three and four in *blanchardi*); the transverse striolæ are long and numerous, and the flattened margin is broader in *sexangularis,* the truncature with acuminate processes in the latter. The femora are equal in both species, the anterior margins bisinuate; there is, however, an important difference in the anterior tibiæ (♀), which are strongly attenuated basally and broadened to apex on the interior margins in *M. blanchardi,* while they are gradually broadened on the exterior margins in *M. sexangularis,* and the figure seems to indicate that they are of the latter type in *M. froggatti,* too.

NEW MOLLUSCS FROM VANIKORO.

By

TOM IREDALE, Conchologist, The Australian Museum.

(Plate V.)

Vanikoro is famed in the history of conchological science through the collections made there by Quoy and Gaimard about one hundred years ago. These celebrated naturalists were on board the French exploring vessel the "Astrolabe," which was at Hobart when news arrived of the fate of the missing La Pérouse. This ship immediately sailed for Vanikoro to verify the report, and while there these naturalists gathered a rich harvest. Many molluscs were collected, and many beautiful paintings from life of these animals were secured. The French Government of that time financed the publication of these in an excellent style, and this work has never been surpassed. The lifelike figures are excellent, full of action, and their reproduction is unequalled. Many new species were named in this account, and through the beautiful figures presented they were easily recognized. Moreover, the material, being deposited in the Paris Museum, was always available to the French malacologists who were busy working at that time.

Since then no expedition has touched Vanikoro and brought back molluscs, and in the present day usage of geographical forms this was a matter of regret. In the Australian Museum there are fairly large collections from New Britain, Funafuti, New Caledonia and Queensland, and species described as from Vanikoro are commonly represented in these series, Vanikoro itself being about equidistant from each. In some cases the same Vanikoro name had been allotted to two separable forms, and without topotypes the exact discrimination of the Vanikoro species was impossible.

Messrs. E. le G. Troughton and A. Livingstone, Zoologists of The Australian Museum, were invited by Mr. N. S. Heffernan, District Officer, to visit the Santa Cruz Group and make natural history collections, and this invitation was gratefully accepted.

The results are excellent and will be dealt with in detail later, but as this Vanikoro expedition is of universal interest this brief note is written to bring it before the scientific world at large.

Quoy and Gaimard recorded some seventy-five species from Vanikoro and Tukopia, while Messrs. Troughton and Livingstone brought back nearly two hundred and fifty species. Most of the species described by Quoy and Gaimard have been recovered, and these have proved invaluable in determining the forms.

As well as Vanikoro the island of Santa Cruz was visited, and species of *Placostylus* (s.l.) were found there, a genus unrepresented on the former island and apparently not previously recorded from the group. Apparently, Santa Cruz Island is of continental connection, showing *Placostylus, Dendrotrochus* and *Partula,* which appear to be more closely related to New Hebrides species than to those from the Solomon Islands. Vanikoro itself is of volcanic origin, though there is a *Partula* living thereon.

Tinakula, an active volcano in the group, was visited and a series of molluscs collected on the rocks. These are interesting, as the species represented were *Nerita plicata* Linné, *Melarhaphe coccinea* Martyn, *M. undulata* Gray, and *Tectarius feejeensis* Reeve. These are some of the most active molluscan travellers, the first and last reaching Sunday Island in the Kermadec Group, the first three occurring more or less as rare stragglers at Lord Howe and Norfolk Islands.

The beautiful figures accompanying this report have been painted by Miss Joyce K. Allan, of The Australian Museum, to whom my best thanks are tendered for the excellent delineations of the species.

ANADARA LIVINGSTONEI *sp. nov.*

(Pl. v, figs. 3-5 and 12.)

This large species, found in the mangroves at Carlisle Bay, Santa Cruz Island, suggests a monster *pilula,* but nothing else has been noted as being closely related.

Shell large, very solid, very obese, oblique, as deep as long, umboes distant, lozenges many and well marked; hinge teeth very numerous and pronounced, a little larger towards the ends; posterior angle very marked.

Right valve with flattened ribs, thirty to thirty-two in number, a little wider than the deep interstices, squarely granulose, the granulation becoming obsolete at about half growth, senile concentric growth lines strongly expressed; interstices smooth save for fine growth lines.

Left valve similar, but ribs lacking granulation and the interstices showing more boldly the growth line striation.

Colour dirty cream, a dark brown periostracum persistent towards the crenulated edges of the valves, which closely interlock, the number of teeth agreeing with the ribs. Internal colouration white, the animal area faintly striate, dull and dirty white.

Hinge teeth perpendicularly longitudinal, save at the extreme edges; the end five or six are much more crass and some of them twisted. The teeth can be separated into two parts by means of a

depression in front of the umbo; on one side about twenty teeth can be counted, on the other about twenty-five.

Dimensions.—Length 64 mm., height 62 mm., depth of conjoined valves 64 mm.

TRIDACNA TROUGHTONI *sp. nov.*

(Pl. v, figs. 9-10.)

Comparatively recently a review of the Australian species of Tridacna was published by Hedley,[1] and last year I studied these wonderful molluscs in life at Michaelmas Cay, off Cairns, North Queensland. There Mr. G. P. Whitley and I collected a large series under Mr. Hedley's supervision and with his assistance. We noted that the colouration of the animals, though in some species variable, could be associated with the species determined by means of shell features, and this point will be more fully dealt with at a later opportunity. Apparently many more species exist in nature than have been allowed by some monographers, and consequently the present form is regarded as very distinct. The eight distinct ribs are peculiar, though *compressa* Reeve is recalled by the figure, but this shell differs in proportions and growth.

Shell small, nearly equilateral, elongate oval, pedal gape large.

Colour creamy white, pearly white internally.

Sculpture consisting of strong radial ribs bearing erect scales, the wide interstices radially lined; the radial ribs number eight before the beak is reached; this does not bear any scaly ribs and is furrowed by half a dozen ridges. The pedal gape bears half a dozen closely set teeth near to the umboes, the dorsal posterior end elongated somewhat sharply.

Dimensions.—Length 72 mm., height 38 mm., depth of conjoined valves 29 mm.

VASTICARDIUM NEBULOSUM *Martyn.*

A magnificent cockle measuring 137·5 mm. in length was collected at Vanikoro. This has been determined as *Cochlea nebulosa* Martyn[2] figured from unknown locality. Martyn's specimen may have been brought home from the New Hebrides or even Santa Cruz by some member of Captain Cook's party. The figure given by Reeve[3] of *Cardium elongatum* Bruguière refers to this species, and the generic location needs consideration. Dall[4] placed the species under *Trachycardium*, where it certainly does not belong. There is a Pacific group, of which this is the largest member (this is probably

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[1] Hedley.—Records Austr. Museum, xiii, 4, 1921, pp. 163-172.
[2] Martyn.—Universal Conchologist, ii, 1786, Pl. cxl.
[3] Reeve.—Conchologica Iconica, ii, Cardium, Pl. ix, sp. and fig. 46, Dec., 1844.
[4] Dall.—Trans. Wagner Free Institute, iii, 5, Dec., 1900, p. 1090.

the second largest cockle in the world), which deserves separate nomination and is here named *Vasticardium,* the present species being selected as type.

PINGUITELLINA *gen. nov.*

(Pl. v, figs. 6-8.)

There is a series of small Tellens ranging round *Tellina nux* occurring in this Pacific area and North Queensland which is recognizable at sight and, showing distinctive features in their teeth and otherwise, deserve generic rank. They have even been classed in *Arcopagia,* which name belongs to an unlike British species. *Pseudarcopagia* and *Scutarcopagia* have been proposed for the large Pacific forms, *T. decussata* Lam. and *T. scobinata* L. These small things disagree in hinge characters, in the muscle scars, and the pallial line, so that figures are here given of the species from Vanikoro, which I regard as *T. robusta* Hanley and for which the above name is proposed, and also of a Vanikoro specimen of *T. scobinata* for comparison.

PLACOSTYLUS Group.

As a factor in the study of zoogeography Placostylus was much discussed by Hedley. Thus an excellent essay was entitled "The Range of Placostylus: A Study in Ancient Geography,"[5] wherein the Melanesian Plateau was suggested for the Placostylus-living area. Later in the same journal,[6] "A Zoogeographic Scheme for the Mid-Pacific" was propounded, and in neither essay is there mention of Placostylus from the Santa Cruz Group, which therefore fell outside the Melanesian Plateau.

In 1900 the species of Placostylus were monographed by Pilsbry[7] and many species were recognized from the New Hebrides and the Solomon Islands, but still none was known from the Santa Cruz Group. Messrs. Troughton and Livingstone brought back specimens collected "on leaves" at Carlisle Bay, Santa Cruz Island. I then found in the Australian Museum collection a series presented by Mr. A. F. Basset Hull who had collected them at Santa Cruz in 1910. The latter were collected at the opposite side of the island and differ appreciably in shape.

The fact that the specimens were collected "on leaves" has produced a quandary, as superficially they agree with members of the *fuligineus* series which Pilsbry regarded as terrestrial and essentially separable from the arboreal forms. Moreover, Pilsbry placed the *fuligineus* series in the section *Placostylus* restricted, which includes discordant species. I therefore introduce the name *Santacharis* with the species *S. hullianus* as type.

[5] Hedley.—Proc. Linn. Soc. N.S.W., (2), vii, 1892, pp. 335-339.
[6] Hedley.—*Ibid.*, xxiv, 1899, ppp. 391-417.
[7] Pilsbry.—Manual of Conchology, (2), xiii, 1900.

SANTACHARIS HULLIANUS *sp. nov.*

(Pl. v, fig. 1.)

Shell of medium size for the group, oval, spire conic, aperture longer than spire, last whorl two-thirds of the shell, rimate, though absolutely imperforate when young. Whorls four.

Colour yellowish, streaked longitudinally with brown, the latter colour predominating on the body whorl, some shells becoming uniformly brown, the early whorls being immaculate yellowish horn.

The apical whorl a little tilted, finely, longitudinally, wrinkly sculptured, the sculpture fading on the second whorl where a spiral striation supersedes it, the latter in its turn sometimes disappearing; at others it persists and is well marked on the body whorl as a wavy, wrinkly sculpture.

Columella a little twisted above, reflected, the umbilicus represented by an almost obselete chink. Parietal callus thin but clearly seen in the dark coloured shells. The outer lip with a distinctly flattened sinuation medially.

Dimensions.—Length 37 mm., breadth 20 mm.

Collected by Mr. A. F. Basset Hull at Santa Cruz Island.

SANTACHARIS HULLIANUS EXPEDITIONIS *sub. sp. nov.*

(Pl. v, fig. 2.)

The shells collected on leaves by the expedition differ at sight, being shorter, stouter, much more solid, with the spire shorter, the sculpture weaker and the outer lip scarcely flattened medially.

Columella more notably twisted and thickened, parietal callus thick, much more pronounced.

Dimensions.—Length 34 mm., breadth 21 mm.

Collected at Carlisle Bay, Santa Cruz Island, by Messrs. Troughton and Livingstone.

Remarks.—Had this series been received from a different island it would have been regarded as distinct by almost any conchologist. As these specimens were undoubtedly collected on trees they are remarkable for their solidity.

NERITA COMMUNIS *Quoy and Gaimard.*

This name was given by Quoy and Gaimard.[8] Tryon[9] has misidentified the species, calling Quoy and Gaimard's species by the

[8] Quoy and Gaimard.—Voyage de l' "Astrolabe," Zoology, iii, 1834, p. 195, Pl. lxv, figs. 12-14.
[9] Tryon.—Manual of Conchology, (2), x, p. 38, Pl. xi, figs. 10-13.

name *Neritina roissyana* Récluz, while using the former's name for another species,[10] to which *N. waigiensis* Lesson[11] is attached as a synonym. Obviously the latter had priority and should have been preferred, and as a matter of fact Burrington Baker[12] has recorded this alteration. At the same time Baker proposed a subgenus *Vittina* (pp. 135, 144) with the species *N. roissyana* Récluz 1841 as type. Apparently *communis* Quoy and Gaimard will displace *roissyana* Récluz, being seven years earlier in date.

TURBO TUBERCULOSUS *Quoy and Gaimard.*

Quoy and Gaimard described this species from Vanikoro and gave a good figure. The species has since been neglected, being regarded as a synonym, sometimes of *radiatus*[13] from which it differs at sight and in opercular features, at others of *spinosus* (*e.g.*, Kuster[14] and Reeve[15]) known as the spiny Silvermouth. The series collected shows the species when living to have a yellow mouth, which at first sight brings it into the *chrysostomus* group, but the operculum differs from that of *chrysostomus* as figured by Pilsbry.[16]

Specimens were collected by Whitley and myself at Michaelmas Cay, North Queensland, which agreed both as to shell features and opercular characters with Pilsbry's determination of *chrysostomus*. The Vanikoro shells differed at sight from these in their elevation and straight whorling agreeing in these features with Quoy and Gaimard's excellent figure, as also does the operculum, well shown by these scientists. From a study of Australian *Turbos* of this series there appears to be a number of allied species differing in opercular features, or otherwise a series of distinct species converging closely in shell features. The subject is somewhat intricate and will be more fully discussed in connection with the Australian forms, but here it may be stated that the Vanikoro shells must be regarded as a distinct species at present.

[10] Tryon.—*Op. cit*, p. 38, Pl. xi, figs. 16-22.
[11] Lesson.—Voy. de la "Coquille," ii, 1830, p. 379.
[12] Burrington Baker.—Proc. Acad. Nat. Sci. Phila., lxxv, 1923, p. 145.
[13] Pilsbry.—Manual of Conchology, x, 1889, p. 200.
[14] Kuster.—In Martini und Chemnitz, Conch. Cab., ii, Abth. 2, 1846, p. 25.
[15] Reeve.—Conchologica Iconica, Vol. iv, Turbo, 1848, Pl. x, fig. and sp. 47.
[16] Pilsbry.—*Loc. cit.* p. 200, Pl. lix, fig. 4.

Explanation of plate I.

Fig. 1. *Chromis lepisurus* (Cuvier and Valenciennes). A specimen, 95 mm. long, from Michaelmas Cay, Queensland.

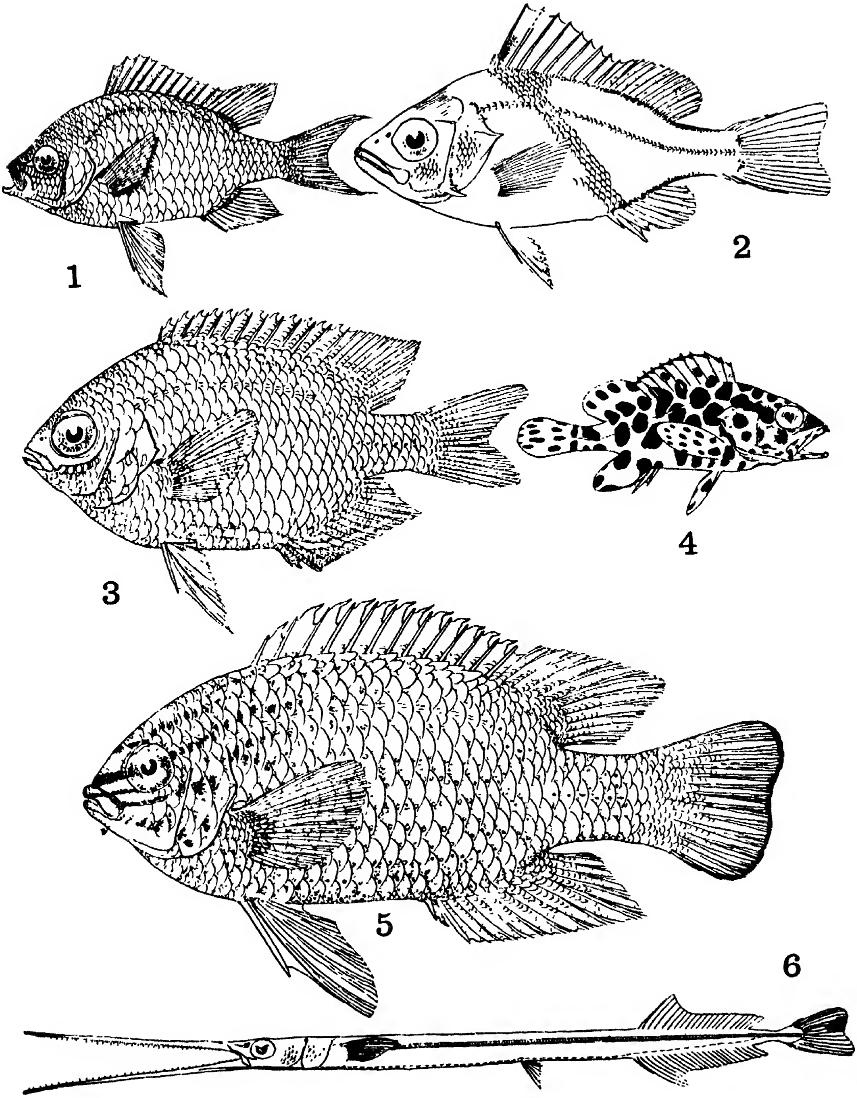
Fig. 2. *Lutjanus sp. juv.* A specimen, 34 mm. long, from Michaelmas Cay, Queensland.

Fig. 3. *Pomacentrus sufflavus* Whitley *sp. nov.* Holotype, 28 mm. long to hypural joint, from Michaelmas Cay, Queensland.

Fig. 4. *Epinephelus merra* Bloch. A young specimen, 46 mm. long, from Michaelmas Cay, Queensland.

Fig. 5. *Glyphisodon hedleyi* Whitley *sp. nov.* Holotype, 53 mm. long to hypural joint, from Dauco Island reef, Papua.

Fig. 6. *Tylosurus terebra* Whitley *sp. nov.* Holotype, 243 mm long, from Michaelmas Cay, Queensland.



G P. WHITLEY, del.

EXPLANATION OF PLATE II.

Atrax robustus O. P. Cambr.

Fig. 1. Dorsal view of female.

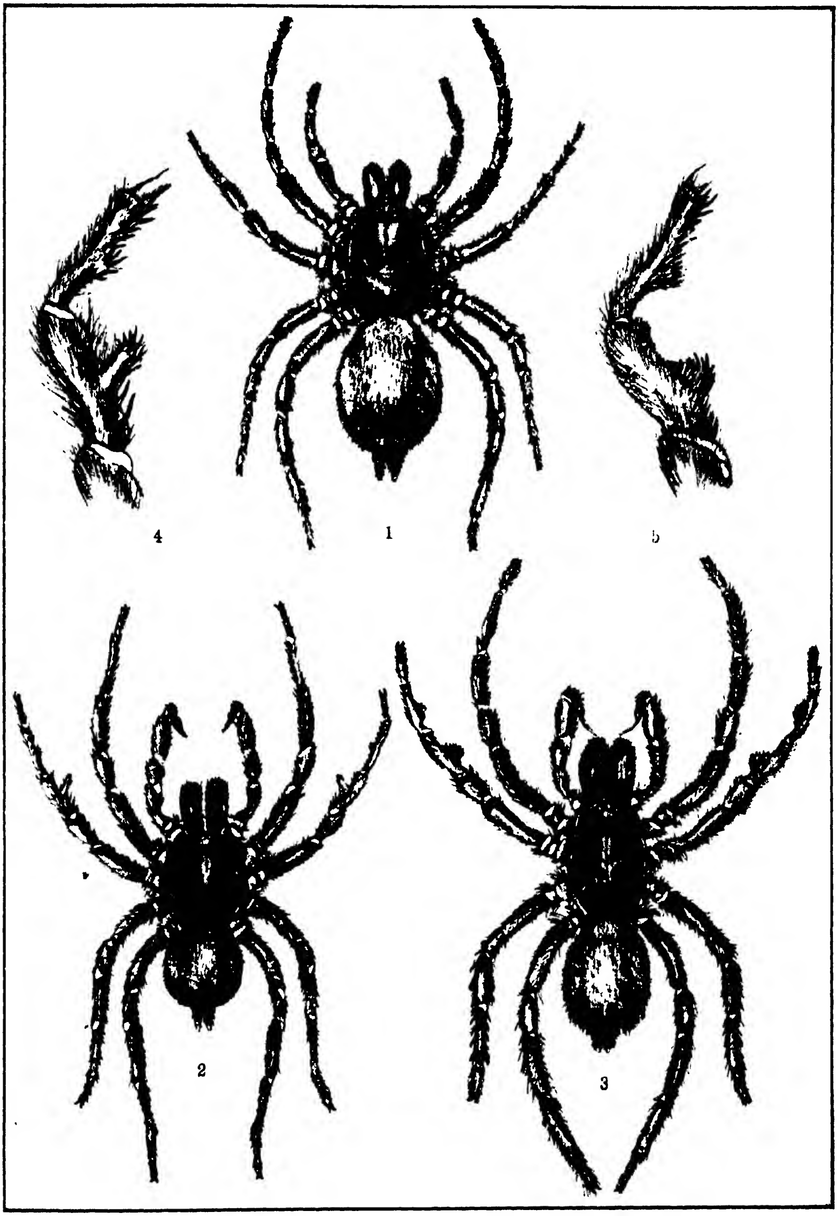
Fig. 2. Dorsal view of male.

Fig. 4. Tibia and metatarsus ii viewed laterally.

Atrax formidabilis Rainbow.

Fig. 3. Dorsal view of male.

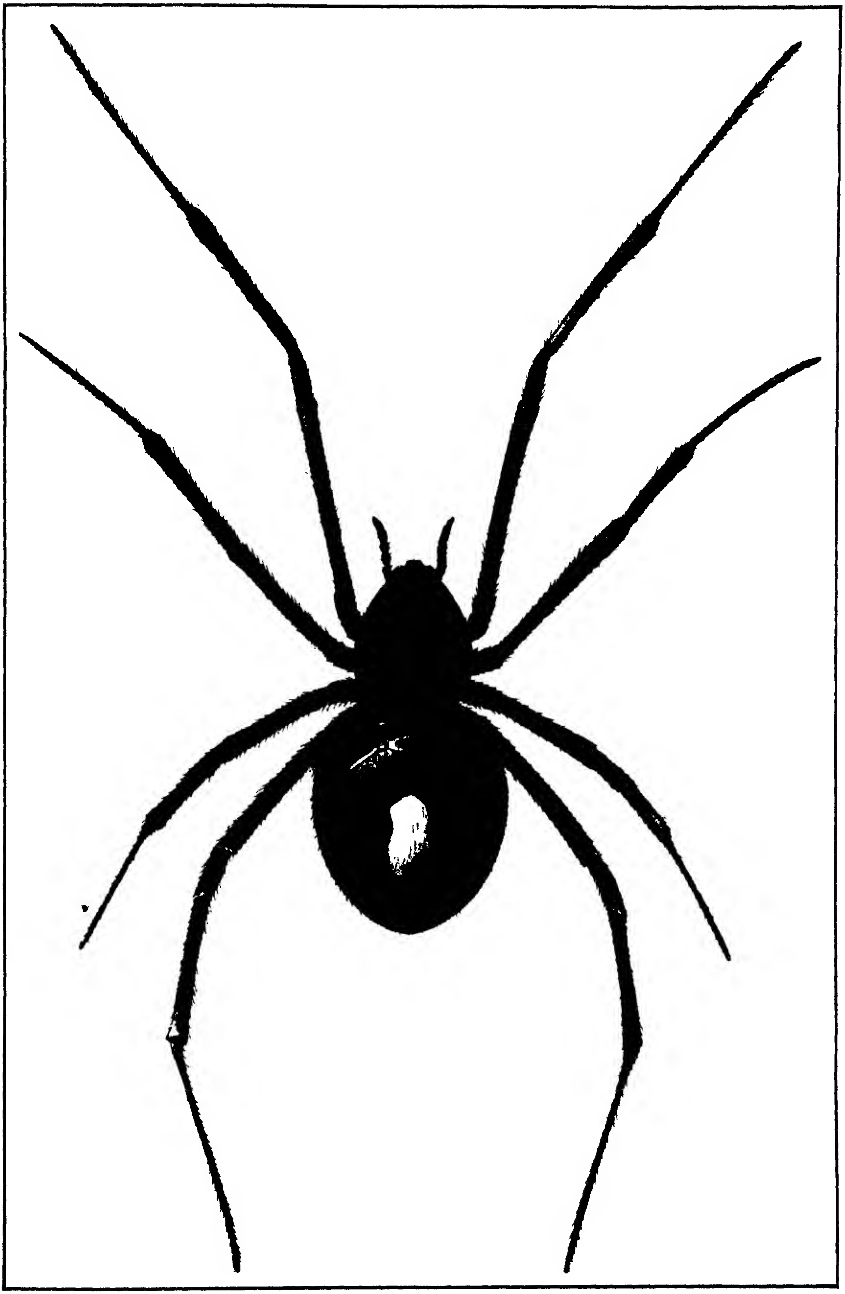
Fig. 5. Tibia and metatarsus ii viewed laterally.



JOYCE K. ALLAN, del.

EXPLANATION OF PLATE III.

Latrodectus hasseltii Thorell. Female. Dorsal view.



PHYLLIS F. CLARKE, del.

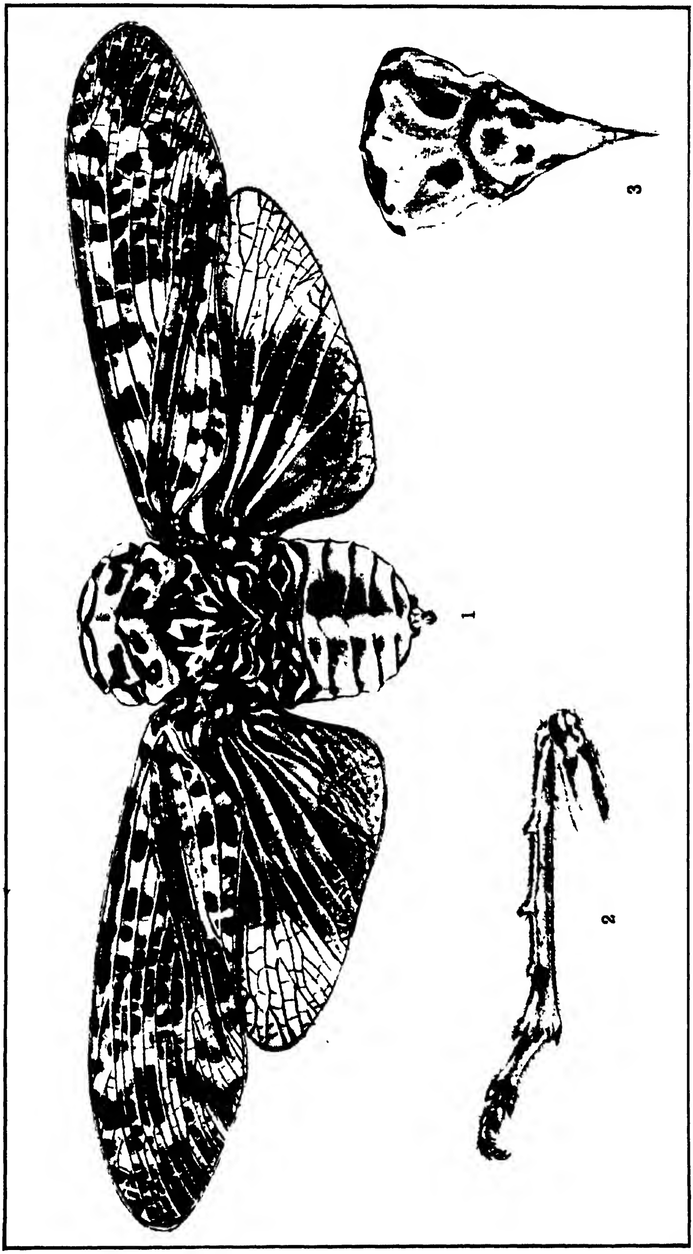
Explanation of plate IV.

Desudaboides fuscomaculata **sp. nov.**

Fig. 1. Dorsal aspect of female.

Fig. 2. Lateral view of posterior tibia of female.

Fig. 3. Face and clypeus of female.



JOYCE K. ALLAN, del.

EXPLANATION OF PLATE V.

Fig. 1. *Santacharis hullianus* Iredale, type.

Fig. 2. *Santacharis hullianus expeditionis* Iredale, type.

Fig. 3. *Anadara livingstonei* Iredale, type.

Fig. 4. *Anadara livingstonei* Iredale, type.

Fig. 5. *Anadara livingstonei* Iredale, type.

Fig. 6. *Pinguitellina robusta* Hanley, interior.

Fig. 7. *Pinguitellina robusta* Hanley, exterior.

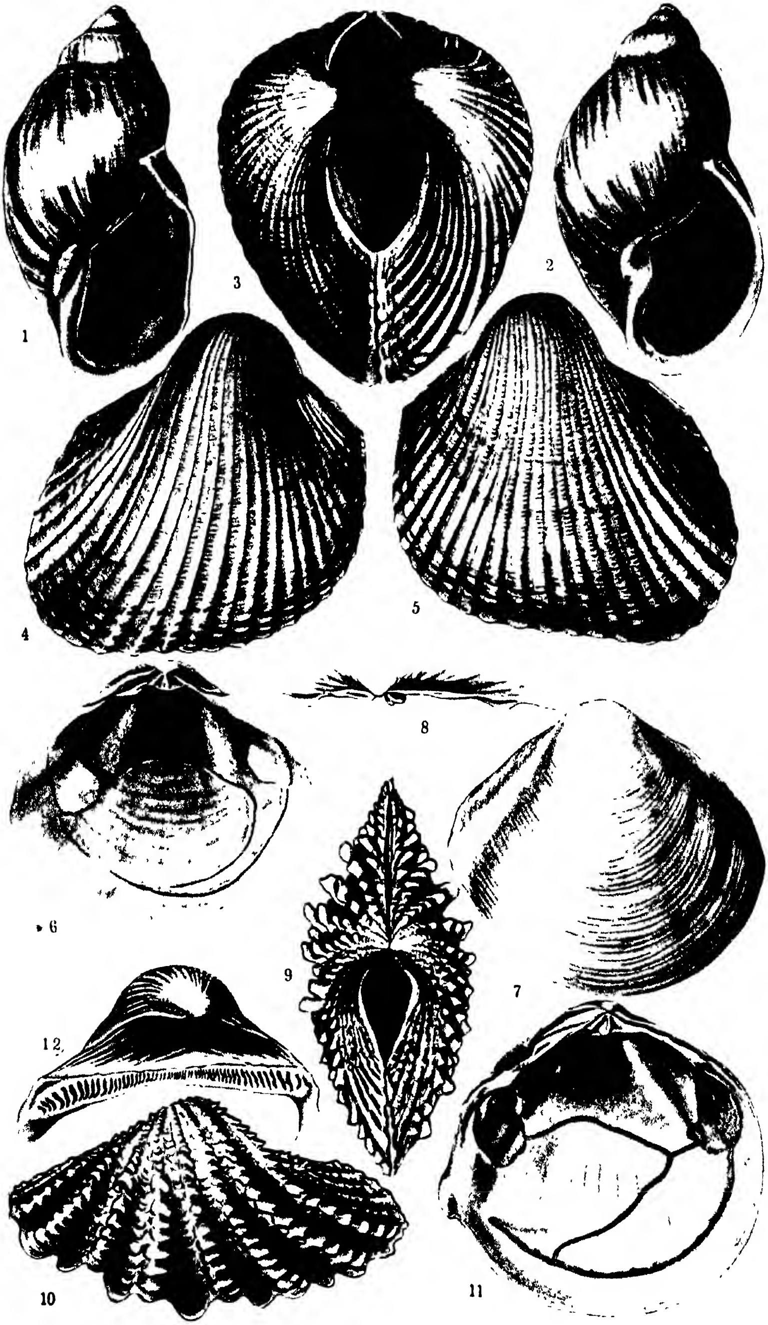
Fig. 8. *Pinguitellina robusta* Hanley, hinge line.

Fig. 9. *Tridacna troughtoni* Iredale, type.

Fig. 10. *Tridacna troughtoni* Iredale, type.

Fig. 11. *Scutarcopagia scobinata* Linné, interior.

Fig. 12. Hinge line of *Anadara livingstonei* Iredale, type.



JOYCE K. ALLAN, del.

ON DIPLOPODA IN THE AUSTRALIAN MUSEUM, SYDNEY.

By

Dr. W. K. Verhoeff, Pasing, near Munich.

(Plates vi-xii.)

CONTRIBUTION 101 ON DIPLOPODA.

(*Translated by C. Anderson, M.A., D.Sc.*)[1]

I have recently completed a description of the Diplopoda collected in Australia by Dr. Mjöberg's Expedition.[2] This work demonstrates once more that our knowledge of Australian Diplopoda is still very incomplete. Of forty-four forms examined by me only one was previously known, and of twenty-eight genera eighteen are new. Moreover, it must be taken into consideration that most of the older descriptions are so defective that recognition according to the much higher scientific standards of to-day is almost impossible, the more so as, for the most part, the morphological and general concepts of the older authors cannot be brought into line with those now prevailing.

Dr. Anderson, Director of the Australian Museum, has been good enough to forward to me a series of the Diplopoda contained in the collection of that museum. These are from New South Wales, and make possible an important increase in our knowledge of the Australian fauna. I wish to express my gratitude to Dr. Anderson for his kindness in entrusting to me the description of the collection; some of the new forms have been dedicated to him.

1. Opisthandria-Chorizocerata *Verh.* 1910.

Family SPHÆROTHERIIDÆ.

In the paper previously referred to I have established a new morphological basis and also a new morphological conception and nomenclature for the treatment of these giant pill millipedes (Riesenkugler), and I would now refer the reader to that paper, especially to my key to the Sphærotheriid genera.[3] The only Australian Sphærotheriid previously known with certainty was *Cyliosoma* Pocock, to which in 1924 I added the genus *Cyliosomella*

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[1] The translation was submitted to the author before being printed.

[2] Verhoeff.—Arkiv f. Zool., K. Svens. Vetenskapsakad., XVI, No. 5, 1924, pp. 142, 5 plates. This is my 97th and 98th contribution on Diplopoda, which, unfortunately, is not indicated on the publication.

[3] Verhoeff.—*Loc. cit.*, pp. 56-60.

from Queensland.[4] The forms described in the present paper show that these two genera occur in New South Wales also, so that we may assume that they are characteristic of the whole of Eastern Australia, and especially of the elevated portions of that region. On page 43 I have compared the most important characters of the two genera, but I must add that the co-telopods (*Nebentelopoden*) of *Cyliosoma* have a uniform syncoxal cross-bar, whilst those of *Cyliosomella* have *separated coxites,* which, however, are united in the median region. The differences in the shape of the thoracic shield emphasized by me hold also for the following new species, so that these habitually very similar genera can be easily distinguished by examining the thoracic shield with a magnifying glass. As regards the cyphopods I refer the reader to the remarks below.

CYLIOSOMA *Pocock.*

1. Key according to external characters.

(*a*) Back more *yellowish brown*, the posterior borders of the tergites dark brown. Bitelotergite *but slightly* shining, densely covered *all over* with *rather strongly developed* punctations, with intervening wrinkles, which, however, are not reticulate, sloping posteriorly at an angle of 55°. In front of the posterior border of the bitelotergite the male has an unpaired roundish *pit* with scattered short bristles .... 1. *excavatum* n. sp.

(*b*) Back *dark brown*, more or less uniform in colour, at the most the collum and lateral portions of the thoracic shield lighter in colour. Bitelotergite shining, in places almost devoid of sculpture, but for the most part *very finely* and more or less closely punctate; very finely wrinkled on the sides, the wrinkles arranged predominantly in a reticulate manner .. *c*, *d*

(*c*) Bitelotergite of the females (at least in the older specimens) with a *ridge-like* longitudinal fold (*gratartige Längswulst*) behind the middle; in the male behind the middle is a *very deep pit*, into which from the front protrudes a longish *hump* (*Buckel*), with a dense *brush* on the posterior end; posterior border projecting in a *rounded obtuse* angle, the *middle densely clothed with short bristles*, between bristles and posterior border an excavated, pitted, posterior portion, which slopes at an angle of 55° .... 2. *penicilligerum* n. sp. (*Paracyliosoma*)

(*d*) Bitelotergite of the female *without* markings, male with various but less conspicuous markings, and in particular never with a deep double pit divided by a hump .... *e*, *f*, *g*

(*e*) Bitelotergite of the male rounded-truncate posteriorly, in the posterior third an elevated median stripe covered with felted hairs, and on each side of this a broad roundish impression. Femoral process of the telopods tapering regularly and smooth on the edge. Femoral lobes of the co-telopods directed endwise and smooth also. The tibiotarsus is elongated and *bent obliquely* towards the end .... 3. *queenslandicum* Bröl.

(*f*) Bitelotergite of the male with a rounded off and *oblique angled* projection posteriorly; in the posterior third a median rather broader, longish, densely pilose area, transversely depressed in front of the pilose region, so that in profile it appears somewhat S-shaped. Telopods and co-telopods as before .... 4. *queenslandicum mjöbergi* Verh.

[4] Verhoeff.—*Loc. cit.*, pp. 43-44, 48-49.

(*g*) **Bitelotergite of the male rounded off and truncate posteriorly, the posterior third with a rounded triangular, broad, densely punctate area with scattered hairs, the region of this area *flattened*, so that in profile, posterior to the middle, it slopes *evenly*. Femoral process of the telopods curved somewhat towards the end, finely *dentate* on the inside anterior to the end. On the co-telopods the femoral lobe is more strongly bent inwards, finely serrated on the end, the tibiotarsus roundish and completely inserted in the hollow of the femur and therefore directed inwards .. 5. *denticulatum* Verh.**

2. Key according to the Telopods and Co-telopods.

(*a*) Femoral process of the telopods *reaching almost to the end of the* tibiotarsus.

× Femoral process curved slightly inwards. Syncoxite horns *divided into two points*, which are bent outwards, a longer outer and a shorter inner one. Tibiotarsus of the co-telopods *close* against the prefemoral lobe, the femur reaching far over it .... 1. *excavatum* n. sp.

×× Femoral process directed *straight endwise*. Syncoxite horns with a single termination. (?) Tibiotarsus of the co-telopods widely *separated* from the prefemoral lobe, only slightly overlapped by the femur .... 2. *penrithense* Bröl.

(*b*) Femoral process of the *telopods* reaching only *about as far as the middle* of the tibiotarsus; syncoxite horns as in *excavatum* .... *c*, *d*

(*c*) Stridulating band on the tibiotarsus of the telopods strongly bent and much nearer to the *outer* than to the inner border; femoral process *broadly rounded-truncate* on the end. Prefemur of the co-telopods 1½ times broader than long, the inner lobe constricted on the inside towards the base. Femur simply rounded on the outside .... 3. *penicilligerum* n. sp. (*Paracyliosoma*)

(*d*) Stridulating band on the tibiotarsus of the telopods less strongly bent, considerably nearer to the inner than to the outer border; femoral process simply rounded-*triangular*. Prefemur of the co-telopods about as long as broad, the inner lobe *not* constricted on the inside towards the base. Femur simply rounded on the outside or obtusely angulated.

4. *queenslandicum* Bröl. 5. *queenslandicum mjöbergi* Verh. 6. *denticulatum* Verh.	**See former key.**

CYLIOSOMA EXCAVATUM *sp. nov.*

Female 21½ to 27½ mm. long by 10 to 13½ mm. broad, male 22 × 9½ mm. In general similar to the *Cyliosoma* species above, resembling *queenslandicum* both in shape and sculpture. Collum smooth and shining, without markings or bristles. This species is distinguished not only by the colour but also, in particular, by the sculpture of the bitelotergite, which, in contrast to the other tergites, is but slightly shining, on account of its being very strongly punctate and wrinkled. The dense sculpture extends over the whole surface to the edges. Posterior border of the bitelotergite is semicircular, in profile sloping posteriorly at an angle of 55°, flattened in the middle third; in this flattened area occurs a large, unpaired, roundish, but shallow pit containing short scattered bristles. The inferior wall of the lateral lobes has a longitudinal furrow and longitudinal band as in *queenslandicum*, approaching

the lateral edge in front and behind. In the latter it reaches almost to the anterior border, but here it is considerably shorter.

On the co-telopods (Pl. vi, fig. 4) the prefemur broadens inwards into a rounded lobe, well covered with bristles, and on the whole more than one and a half times broader than long. The rounded-conical tibiotarsus is deeply inserted in the femur close behind the prefemoral lobe, and the slender femur, which is considerably longer than broad, and is inclined inwards, projects far beyond the tibiotarsus.

On the telopods (Pl. vi, fig. 1) the prefemoral process is bent inwards somewhat, and extends endwise almost as far as the tibiotarsus. The latter carries posteriorly, and much nearer to its inner than its outer edge, a curved *stridulating band,* which consists of 22 to 25 transverse ridges (*Querwülste*) (Pl. vi, fig. 2), which, like a *file,* are ribbed by parellel, curved, extremely fine bands. In the young male the stridulating band lies about in the middle between the inner and the outer border. Syncoxite of the telopods in the male and young male similar in form, but in the male (Pl. vi, fig. 3) the coxite horns (*pr.*), which are bent outwards and somewhat *backwards,* extend far beyond the lobes, while in the young male, on the contrary, the lobes extend somewhat farther. In the young male the inner border of the tibiotarsus is almost straight, in the male it is decidedly bent, and, generally, the whole tibiotarsus is more strongly curved inwards. The femoral process has in the male a membranous accessory lobe, but close to the tibiotarsus this is hidden as in Pl. vi, fig. 1. The three segments of the telopod-telopodite have the usual long *slender* bristles, which are present in *queenslandicum* also. On the femur these are scattered over almost the entire surface, but are more abundant posteriorly.[5]

Occurrence.—New South Wales. Several specimens, some from the Upper Richmond River (April), some from an unknown locality.

The genus *Cyliosoma* is divided by me into *two subgenera*:

(*a*) *Cyliosoma* s. str. Antennæ with *four* olfactory cones, the bitelotergite of the male with various markings, unpaired or paired shallow pit, with a tubercle or a felted protuberance (*Wulst*), or a setigerous area, but never with a deep concavity. Prefemur with simple bristles only (the remaining species).

(*b*) *Paracyliosoma* n. subg. Antennæ with *seven* olfactory cones, the bitelotergite with short horseshoe-shaped, very deep pit

[5] How little systematic significance the tarsal spines have was observed by me in the case of a specimen of *queenslandicum* (among others) which on the tarsus of the last pair of legs in front of the claw has on the left one spine, on the right two.

(Pl. vi, fig. 7), and a protuberance therein with a broad brush. Telopods, particularly on the prefemur, with pencil-like bristles (only *penicilligerum* Verh.).

CYLIOSOMA PENICILLIGERUM *sp. nov.*

Male $18\frac{1}{2} \times 8$, largest female $23 \times 9\frac{1}{2}$ mm. *Collum with sparse rather coarse punctations with long erect bristles.* The thoracic shield and other tergites shining and very weakly sculptured, slightly wrinkled in a reticulated fashion on the inner areas of the thoracic shield. Sculpture of the bitelotergite likewise very fine, the sides especially with very fine striæ; in the female on the posterior third is a ridge-like median protuberance, which passes on each side into slight impressions (a feature which is, however, merely indicated in the younger females). In the male, in which the posterior border of the bitelotergite, in contrast to the almost semicircular form in the female, projects forward in an obtuse angle, the posterior half has in the middle third a very deep, short, horseshoe-shaped *pit* (Pl. vi, fig. 7), into which projects from in front a broad *protuberance*, which ends posteriorly about in the middle of the pit in a broad and very dense *brush*. In front of the brush the protuberance is covered with scattered and rather long bristles, and behind it the posterior part of the pit falls at an angle of 45°, and, like the posterior border, is covered with short bristles, the latter almost brush-like in density. Undersurface of the lateral lobes with longitudinal bands and furrows as in *queenslandicum*.

On the co-telopods the prefemur (Pl. vi, fig. 6) rises more steeply on the inside than in the preceding species, the femur is much shorter, more deeply inserted in the prefemur, and more broadly rounded terminally, hence it projects but slightly over the tibiotarsus. The telopods (Pl. vi, fig. 5) are characterized not only by their shortness but also by their broad, oblique, terminal truncation. The stridulating band is strongly curved and is close to the outer border; it consists of twenty ridges, the bands file-like as in the other species, but the bands are not so closely set as in the foregoing species. The syncoxite horns scarcely extend beyond the lobes, and are at the same time not bent back but directed obliquely outwards and endwise. More than all others this species is distinguished by the fact that the telopods have a border of *pencil-like* bristles, which, on the prefemur, occur scattered on the posterior surface, while on the exterior part of the femur and the base of the tibiotarsus they are restricted to two small groups. These *bristle pencils* are not only *much thicker* than those occurring in other species but they also taper much less towards the end.

Occurrence.—New South Wales. A female and four males from North Dorrigo, collected by A. Musgrave.

CYLIOSOMA QUEENSLANDICUM *Brölemann.*

Male 28-30 × 13-15 mm., female 33-39 × 15½-17 mm. The longitudinal ridge (*Längswulst*) on the bitelotergite of the male appears as a narrow, yellowish, longitudinal brush. If this is removed a very fine dense punctation is revealed, which contrasts sharply with the almost smooth surrounding area, in particular with the shallow pits on either side. Body dark chestnut-brown, only the anterior border and the lateral lobes of the thoracic shield, as well as the collum, are more or less greyish-yellow.

Occurrence.—Several specimens from the Upper Richmond River, New South Wales (April), and from another unknown locality, among them three males.

Remarks.—I particularly direct attention to the fact that Bröleman's illustration of the telopods[6] is scarcely correct. In all *Cyliosoma* species examined by me the horns of the syncoxite are divided terminally into two branches as in my Pl. vi, fig. 3 (*pr.*), and I am convinced that this holds also for *Brölemann's* species. On the telopods of *queenslandicum* the stridulating band has only 20 to 21 *ridges,* and these are again file-like as in Pl. vi, fig. 2. The *stridulating band* differs from those of the two preceding species, not only in its *slightly S-shaped curvature,* but also in that it terminates at a certain distance from the end of the tibiotarsus, and then comes a rather distinct marginal piece without ridges. Of the genus *C. queenslandicum* is apparently the species most widely distributed in Eastern Australia.

The Cyphopods of CYLIOSOMA.

The three foregoing species can be distinguished according to the cyphopods.

(*a*) Termination about *as long as broad,* rounded-triangular, slightly *emarginated* on the outside .... *queenslandicum*

(*b*) Termination decidedly *broader* than long, *not* emarginated on the outside.

× Termination scarcely so long as the outer basal piece, stalk of the receptaculum seminis long .... *penicilligerum*

×× Termination somewhat longer than the basal piece, stalk of the receptaculum seminis short .... *excavatum*

CYLIOSOMELLA *Verhoeff.*

In my cited work on Dr. Mjöberg's Diplopoda I was able to describe the male only. My opinion that the females also would differ generically in the cyphopods is confirmed by what follows. The cyphopods in *both* genera consist of *three* separate segments.

[6] Brölemann.—Rec. Austr. Mus., x, 1913, Pl. xiv, fig. 3.

CYLIOSOMA (female).

Cyphopods *much exceeded* on the outside by the coxæ of the second pair of legs, therefore much narrower than those. The two basal pieces extend downwards to an almost equal extent, but, although the inner appear somewhat shorter, the outer are never pushed behind the inner. The two basal pieces therefore have a *common basal border*, and the stalk of the receptaculum seminis extends to this. At its base the terminal piece is transversely bounded or forwardly bent towards the base; it does not extend to, or only slightly into the region of the prefemur.

CYLIOSOMELLA (female).

Cyphopods unusually large, the *same breadth as the coxæ* of the second pair of legs. Of the two basal pieces, the outer, which is in general twice as large as the inner, *extends far behind the latter*, so that there is no common basal edge. At its base the end piece is terminally emarginated in its full width, and at the same time it extends as far as the middle of the prefemur.

For the two *Cyliosomella* species, namely, my earlier *castaneum* from Queensland[7] and the new species from New South Wales, I give here a summary of the most important differences.

CYLIOSOMELLA CASTANEUM *Verh.*

Bitelotergite of the male with elongated *tubercles* (*Höcker*) before the posterior third, otherwise weakly punctate. Femoral process of the telopods distinctly *shorter* than the tibiotarsus, the latter *without* stridulating ridges. Accessory lobe (*Nebenlappen*) of the femoral process triangular. Femoral process of the co-telopods *not* distinctly marked off, slightly emarginate on the terminal border and without accessory lobes. Tibiotarsus without *serrations* (*Höckerchensäge*) at their ends; the syncoxal processes of the telopods are produced in triangular points but these are not specially defined.

C. ANDERSONI *sp. nov.*

Bitelotergite of the male *without* tubercles, but anterior to the middle of the posterior border is a shallow *pit*, which with the area near it is densely clothed with short bristles; the sides of the bitelotergite are wrinkled with fine striæ. Femoral process of the telopods extends forward almost as far as the tibiotarsus; the accessory lobe is broadly rounded. Tibiotarsus with a distinct series of *stridulating tubercles* on the inside. On the syncoxal processes the end is fully rounded and the accessory processes are sharply defined there against. Femoral processes of the co-telopods are sharply and fully *marked* off at the base, *deeply* emarginate on the terminal border, and with membranous accessory lobes on the inside. Terminal joint of the co-telopods with *serrations*.

CYLIOSOMELLA ANDERSONI *sp. nov.*

Male 23½-27½ × 11-12 mm., female 32-36 × 16-16½ mm. Antennæ with four olfactory cones, the sixth segment slightly cask-shaped and emarginated, 1¾ times longer than broad, also 1¾ times longer than the fifth segment. Thoracic shield as in *castaneum*. Collum smooth and shining, with only a small pit behind the anterior border. Transverse row and boldly projecting ciliary bristles.

[7] Verhoeff.—*Loc. cit.*, pp. 48-49.

Tergites predominantly smooth and shining with only sparse and fine punctations. Inner lobe of the thoracic shield with fine wavy wrinkles.

Bitelotergite finely but rather densely punctate, with fine wavy wrinkles on the sides; a shallow but distinct longitudinal *impression* in front of the middle of the posterior border. This and the area near it is rather more strongly punctate, and at the same time more densely covered with very short disparate (*abstehende*) bristles, and also with some scattered longer ones. Bitelotergite forming a rounded arc, the posterior descending *perpendicularly*, a fine marginal furrow in front of the posterior border. Inferior wall of the lateral lobes very close behind the anterior border, and with a black, shining, extremely short, narrow, oval protuberance (*Wulst*), but without furrow.

On the cyphopods of the female (compare above) the terminal piece is triangular, the outer side $1\frac{2}{3}$ times longer than the inner. Base of the receptaculum tapers in a triangular form and then passes into a stalk. Tarsus of the last pair of legs of the male has one spine in front of the claw on the outside and seven on the inside.

The *co-telopods* (Pl. vii, fig. 8), which I have previously dealt with, have on the tibiotarsus a stridulating band consisting of 8-9 slight simple tubercles without file-like ridges. On the stridulating band of the telopods also (Pl. vii, figs. 9, 10) only simple tubercles are to be seen, and file-like ridges such as are found in *Cyliosoma* are absent.

The femur is distinctly longer than the prefemur (in distinction to *Cyliosoma*) and about as long as broad. The spinescence (*Beborstung*) of the telopods is simple; the bristles therefore are long and thin. In front of the termination of the femoral process one can see on the inside a small swelling (*Wulst*). Between the two pincers (*Zangenarmen*) projects a rather large, rounded, membranous lobe on the inner base of the femoral process (Pl. vii, fig. 10). The processes of the syncoxite extend beyond the coxal lobes, are broadly rounded on the end, and produced outwards in short, simple and blunt projections. For further details I would refer to Pl. vii, figs. 9 and 10.

Occurrence.—Several specimens from the Upper Richmond River, New South Wales, have been examined.

Cyliosomella andersoni dorrigense *subsp. nov.*

Male 27 × 12 mm. This is distinguished from *andersoni* by a *scattered but coarse punctation* on the thoracic shield and the succeeding tergites. It differs in particular in the structure of the bitelotergite, on which the dense simple punctation is more strongly impressed. In addition there are irregular scattered corrugation pits (*Runzelgrübchen*). The posterior half is covered

in the middle with short scattered bristles with some longer ones in between, but neither a *pit nor a swelling* is developed; the bitelotergite does not descend vertically behind, but slopes at an angle of about 70°.

Antennæ with four olfactory cones, but on one of the two antennæ, in addition to the four normal larger olfactory cones, there are also two abnormal and more slender ones (hence the enumeration is 4 + 2).

Occurrence.—The single male comes from North Dorrigo, New South Wales, collected by A. Musgrave.

II. POLYDESMOIDEA.

Family STRONGYLOSOMIDÆ.

In my work on Mjöberg's Australian Diplopoda[8] I have dealt with the morphology of the Strongylosomid gonopods, and in regard to the new forms described below I make the following observations.

The six new genera, namely, *Paraulacoporus, Myallosoma, Rhopalowales, Walesoma, Leucotessara* and *Hoplatessara,* show us once more the greatest variation in the structure of the gonopods, and particularly in the expansion of the femur, the development of its lateral rami (*Nebenäste*), the size, position, and form of the solænomerite and of the tibiotarsus, the relative size of both, and particularly their condition of separation or union. In the work mentioned above I have also stressed the necessity for taking into consideration more than formerly the structure of the sides of the pleurotergites of the body, namely the lateral folds (*Seitenwülste*), lateral furrows (*Seitenfurchen*), and the position of the repugnatorial pores (*Wehrdrüsenporen*). Forms which from consideration of the gonopods show themselves to be the closest allies also show agreement or great similarity in the structure of the sides of the body. On the other hand, forms in which the structure of the sides of the body is very similar may nevertheless have very differently shaped gonopods, for example, *Australiosoma* and *Walesoma*, or *Paraustraliosoma* and *Leucotessara*. Certain primitive characters are again found among the new forms. Thus *Myallosoma* (Pl. vii, figs. 12, 13) has on the tibiotarsus, behind the femoral lateral ramus, a basal portion separated off by a constriction on the outside, but in *Leucotessara* (Pl. ix, fig. 20) this basal portion (*tt*) is not merely marked off on both sides by a constriction (*y*), but on the outside there is a deep incision, so that the terminal portion is separated from the base by a neck. In both cases we have to deal with demarcation which we must refer to the primary articulation between tibia and tarsus. The demarcated termination with its hook-like process in *Leucotessara* (Pl. ix, fig. 20, *c*) suggests a *terminal claw* (*ungulum*), a condition which,

[8] Verhoeff.—*Loc. cit.*, pp. 3-8, 12-15.

moreover, forcibly recalls that of *Australiosoma hamuligerum* Verhoeff.[9] The primitive complete separation of solænomerite and tibiotarsus is shown among the new forms by *Leucotessara* (Pl. ix, fig. 20) and *Hoplatessara* (Pl. ix, fig. 21), whilst in *Rhopalowales* (Pl. viii, fig. 14) there is only a slight fusion, which is more pronounced in *Myallosoma* (Pl. vii, fig. 12). Gradations in the reduction of the true tibiotarsal section and stronger development of the solænomerite are found in *Paraulacoporus* (Pl. vii, fig. 11) and *Solænodolichopus* (Pl. x, figs. 24, 26), whilst *Walesoma* (Pl. viii, fig. 16) has only a hooked remnant (*ta*) of the tibiotarsus, and thus forms a transition to the genera which, like *Helicopodosoma* and *Otoplacosoma*,[10] have suffered complete loss of the tibiotarsus.

I must here mention an interesting feature of the *spermatic canal*, which is important also in regard to homologous structures. I refer to an exceptionally developed *loop structure* (*Schleifenbildung*) which forms a *kink* (*Knickung*) in its course. In *Rhopalowales* (Pl. viii, fig. 15 *u*) and *Hoplatessara* (Pl. ix, fig. 22 *d*) this loop can be traced *to the extreme point of the lateral ramus* of the solænomerite; that is the spermatic canal does not run direct to the place where it opens but follows a *very roundabout course*. The beginning of such a detour is found in *Paraulacoporus* (Pl. vii, fig. 11) and *Dicladosoma* (Pl. viii, fig. 18), in which the spermatic passage bends towards the accessory process, but this deviation is so short that it forms only a semicircular arc. In *Rhopalowales* and *Hoplatessara* on the contrary the loop of the spermatic canal traverses the *entire* length of the lateral ramus.

As in my previous paper,[11] I give here also, with reference to the two new genera, two new generic keys, one according to the gonopods, the other on the basis of other characters.

A. Key to Australian Strongylosomidæ according to the structure of the body rings.

(*a*) Body with either lateral folds (*Seitenwülste*) or with narrower or broader lateral wings (*Seitenflügel*); gland pores always widely separated from the lateral furrows .... *c*, *d*

(*b*) Never with lateral folds or lateral wings, at the most with lateral furrows, and then the gland pores are situated in or close to them, but often the lateral furrows are completely lacking (only the collum and second or second-fourth pleurotergites are different) .... *l*, *m*

(*c*) Body with short but true lateral wings, those of the second pleurotergite the largest; they form ear-shaped plates, rounded anteriorly and posteriorly, and extend laterally farther than the remaining lateral wings; seen from above they project unusually far obliquely forward and outward over the collum .... 1. *Otoplacosoma* Verh.

(*d*) Body with folds or lateral wings, those of the second pleurotergite never exceptionally strongly developed .... *e*, *f*

[9] Verhoeff.—*Loc. cit.*, pp. 26-27, fig. 15.
[10] Verhoeff.—*Loc. cit.*, pp. 28, 31, figs. 17-19.
[11] Verhoeff.—*Loc. cit.*, pp. 9-12.

(*e*) Most of the lateral folds are produced posteriorly into more or less strongly developed *points at the posterior angle*, the folds exceptionally deep on the inside near these points .... *g*, *h*

(*f*) Most of the lateral folds *completely rounded behind*, only some of the most anterior ones (second-fourth) produced into points behind .... *i*, *k*

(*g*) Posterior angle point shorter and rounded off, gland pores situated behind the middle of the folds, not contiguous either to the posterior angle or to the inferior border Lateral furrows strongly bent inwards in front, rather widely separated from the suture.

× First pair of legs of the male has on the femur a strong process on the inside, and an almost hemispherical gibbosity (*Aufwölbung*) on the outside, also the postfemur is almost hemispherically convex on the outside without pegs (*Zapfen*) between the coxæ of the tenth pair of legs.

a Legs with light and dark rings, back with V-shaped white markings on the metazonites ...... 2. *Dicladosoma* Bröl.

β Legs not ringed, back uniformly dark in colour .... 3. *Hoplatessara* g. n.

×× Process on the femur of the male displaced backwards, femur and prefemur less swollen, the latter only slightly bent on the outside. Back brown, with broad light-yellow longitudinal bands in the middle.

a Two elongated *pegs* between the coxæ of the tenth pair of legs of the male .... 4. *Myallosoma* g. n.

β No pegs between these coxæ ...... 5. *Rhopalowales* g. n.

(*h*) Posterior angle point longer and more acute.

× Gland pores on the interior border of the lateral folds. Lateral furrows bent only slightly inwards, running almost straight along the suture in front but at some distance from it. Process on the femur of the first pair of legs of the male; this is obtuse and displaced somewhat backwards. Body uniformly black in colour .... 6. *Helicopodosomella* Verh.

×× Gland pores placed exteriorly, only a little removed from the termination of the posterior point. Lateral furrows curved inwards in strong arcs even anterior to the middle, a little distance from the suture. Femur on the first pair of legs of the male without process. Body with light and dark rings .... 7. *Mjöbergodesmus* Verh.

(*i*) Lateral folds appear like *very short* lateral wings, which on the second-fourth pleurotergites are produced in triangular posterior points. Two lateral furrows are curved inwards in strong arcs in front, and pursue a short transverse course somewhat behind the suture, and posteriorly they are bent at an angle of almost 90° in front of the posterior margin. Metazonites finely wrinkled as if by a needle point .. 8. *Helicopodosoma* Verh.

(*k*) Lateral folds weaker, the lateral furrows *abbreviated*, very far distant from the suture in front, therefore neither bent in front nor produced behind. Pleurotergites 2-4 without posterior point, or at most with a short angulation.

× Lateral folds of the second-fourth pleurotergites completely *rounded* posteriorly, sternite of the sixth pair of legs of the male *without* marking.

a Coxæ of the seventh pair of legs of the male produced into pegs. First pair of legs of the male with small protuberance on the inside of the femur, not displaced posteriorly .... 9. *Australiosoma* Bröl.

β Coxæ of the sixth and seventh pair of legs of the male expanded into a bulge on the inside. First pair of legs of the male with a strong process on the inside of the femur .... 10. *Leucotessara* g. n.

γ Coxæ of the sixth and seventh pair of legs of the male without marking. Femur of the first pair of legs of the male as in *Australiosoma* .... 11. *Walesoma* n.g.

×× Lateral folds of the second-fourth pleurotergites produced posteriorly in rather sharp angles. Sternite of the sixth pair of legs of the male with two paramedian protuberances. Coxæ of the sixth and seventh pair of legs simple. Protuberance on the first pair of legs displaced posteriorly..12. *Paraustraliosoma* Verh.

(*l*) Instead of the disappearing lateral folds we find *lateral furrows*, and in or on them lie the gland pores. Femur on the first pair of legs of the male without larger process, but with or without pegs ....
.... 13. *Aulacoporus* Verh.
.... 14. *Paraulacoporus* g. n.

(*m*) On the sides of the pleurotergites near the gland pores we find *neither lateral folds nor lateral furrows.*

× Metazonites without transverse furrows, body small, third and fourth pleurotergites without lateral furrows ....
.... 15. *Pseudostrongylosoma* Verh.

×× Metazonites with strong transverse furrows, body larger, third and fourth pleurotergites with deep, curved, lateral furrows ....
.... *Solænodolichopus* Verh.
(Compare also *Antichiropus* Att.)

B. Key to Australian Strongylosomidæ according to gonopods.

(*a*) Gonopods not forked and without lateral rami, twisted helicoidally at the end, the spermatic duct opening on the end of the screw ...... *c, d*

(*b*) Gonopods forked or with many branches, or at least with one lateral ramus, not twisted helicoidally at the end .... *e, f*

(*c*) The hooked, backwardly bent end of the helicoidal termination is expanded towards the end and concave *like a spoon* ....
.... 1. *Helicopodosomella* Verh.

(*d*) The helicoidal end tapers off gradually.

× Gonopods with a *club-like* termination, from which the helicoid comes off laterally .... 2. *Otoplacosoma* Verh.

×× Gonopods *without* club, with two sharp bends at the end, small, and with two points .... 3. *Helicopodosoma* Verh.

(*e*) Femur rather long, with club-like thickening, solænomerite long, fused as far as the middle with the tibiotarsus, which from here appears as a broad, backwardly bent, spoon-like lateral branch ....
.... 4. *Mjöbergodesmus* Verh.

(*f*) Tibiotarsus *never* bent back as a broad spoon-like lateral branch, and at the same time fused as far as the middle with the solænomerite .. *g, h*

(*g*) Femur *several times longer than broad*, therefore very slender, never divided, at least as long as the telopodite, and closely applied to the latter (Pl. viii, fig. 16) .... *i, k*

(*h*) Femur either scarcely longer than broad, or, if longer than the solænomerite, separated therefrom as far as its base, or the femur is on the whole only poorly developed. Sometimes the femur is somewhat longer than broad, but even then it is shorter than the terminal telopodite (*Resttelopodite*) and not closely applied to the latter .... *l, m*

(*i*) Telopodite primarily divided behind the end of the femur into solænomerite and tibiotarsus, the latter extending beyond the former .... 5. *Pseudostrongylosoma* Verh.

(*k*) Telopodite simple behind the end of the femur, on which there may be one to two lateral rami, traversed along its length by the spermatic canal; therefore a primary tibiotarsus is not developed.

× The spermatic canal opens at the extreme end of the telopodite, and an accessory process (*Nebenfortsatz*) does not occur either in front or behind the opening of the spermatic canal.

α End of the femoral section with 1-2 accessory processes, femur longer than the terminal telopodite. Femur on the first pair of legs of the male without larger process, with or without small pegs in the same place .... 6. *Aulacoporus* Verh.

β End of the femoral section *without* accessory process, femur scarcely as long as the terminal telopodite. Femur on the first pair of legs of the male with strong process (Pl. viii, figs. 16, 17) .... 7. *Walesoma* n.g.

×× The spermatic canal terminates *before* the end of the telopodite, and there is an accessory process in front of and behind the opening.

α Femur either without accessory process at the end or with two differing greatly in size; the terminal telopodite on the side opposite to the opening of the spermatic canal and the lateral processes enclosing this, *without* lateral ramus .... 8. *Solänodolichopus* Verh.

β Femur with two large very similar spine-like processes on the end; the terminal telopodite on the side opposite to the canal opening with a *lateral ramus* which is forked at the end (Pl. vii, fig. 11) ...... 9. *Paraulacoporus* n.g.

(*l*) *Solænomerite* separated from the femur *to the base* of the latter, tapering *lash-like* and enclosed in a sheath of the tibiotarsus. Femur one and a half to twice as long as broad .... 10. *Paraustraliosoma* Verh.

(*m*) Solænomerite neither lash-like nor sheathed by the tibiotarsus, of very stout form, and resting on the *end* of the femur; the latter only seldom longer than broad, mostly quite short .... *n*, *o*

(*n*) Femur quite *without* a lateral ramus on the end. Solænomerite divided into two short branches at the end with a tendency to form an accessory loop (*Nebenschleife*) of the spermatic canal. Solænomerite and tibiotarsus completely separated, the latter without median constriction (Pl. viii, figs. 18, 19) .... 11. *Dicladosoma* Bröl. Verh. char. em.

(*o*) Femur with *one* or *two* lateral rami on the end .... *p*, *q*

(*p*) Solænomerite and tibiotarsus *fused in the basal moiety*, a *forked* lateral ramus on the end of the femur. Solænomerite divided into two branches, one with the spermatic canal opening, the other with a long *accessory loop* (Pl. vii, figs. 12, 13). Prefemur roundish and short, transversely separated from the femur (*gegen das Femur quer abgegrenzt*) .... 12. *Myallosoma* g. n.

(*q*) Solænomerite and tibiotarsus remain primarily *separated* to the end of the femur, or at most are fused in the basal fourth .... *r*, *s*

(*r*) End of the femur with only *one* lateral ramus which is *not* forked.

× Solænomerite with three branches at the end, the spermatic canal opening on the middle one, but without accessory loop. Tibiotarsus very large, divided into two segments by a median constriction, bent back, hook-like at the end.................... .... 13. *Australiosoma* Bröl. Verh. char. em.

×× **Solænomerite ending in two branches with a large lobe between them, the spermatic canal opening on the bent branch and forming an *accessory loop* on the extended branch. Tibiotarsus smaller and forming a concave cap over the branch containing the canal opening. Prefemur wedge-shaped, pushed sharply forward against the femur, and drawn out (Pl. viii, figs. 14, 15) .... 14. *Rhopalowales* g. n.**

(*s*) End of the femur with *two* long, lanceolate, lateral rami.

× **Tibiotarsus club-like on a long stalk, *not* divided into two segments, and without terminal hook. Solænomerite divided into three processes at the end, the spermatic canal opening on the inmost, an *accessory loop* in the middle one (Pl. ix, figs. 21, 22) .... 15. *Hoplatessara* g. n.**

×× **Tibiotarsus club-like but divided by a pronounced constriction into *two* segments; with strong hook at the end. Solænomerite with *simple* lobe at the end .... 16. *Leucotessara* g. n.**

1. WALESOMA HELMSII, *gen. et sp. nov.*

Male 33½ × 4 mm., female 32 × 4⅓ mm. Back unicoloured, brownish black, abdomen lighter in colour, legs yellowish. Head with scattered setæ in front and with some pits and longitudinal wrinkles. Vertex furrow deep, three setigerous pits on either side between the antennal pits. Sides of the collum rounded and with deep marginal furrow. Lateral folds of the second pleurotergite projecting posteriorly with rounded tip, the third and fourth fully rounded posteriorly, as well as the succeeding lateral folds. Pores on fifth, seventh, ninth, tenth, twelfth, thirteenth, fifteenth to nineteenth rings therefore exhibiting the typical distribution.

Prozonites dull, metazonites rather shining, with slight wrinkling. Pores about equally distant from the lateral folds. Lateral furrows strongly bent anteriorly, widely separated from the sutures.

Transverse furrows deep, widely separated from the lateral furrows. Sutures finely pearled. The truncated and backwardly directed terminal process with a small point on either side.

Femur of the first pair of legs in the male with strong setigerous process projecting at an obtuse angle over the inner margin. Femur and postfemur slightly arched forward on the outside. Coxæ of the second pair of legs of the male somewhat emarginate at the end near the opening of the vasa deferentia. The downwardly-projecting sternite plate between the triangular coxæ of the sixth and seventh pairs without expansion and without process.

The gonopods (Pl. viii, figs. 16, 17) are characterized by their slender and simple form; femur and terminal telopodite about equally long, demarcated on one side only by a constriction. The slender terminal telopodite has in the middle on the outside a spinous bent process (*ta*), the slight remnant of a free tibiotarsus, and on the inside opposite to this is a slender bent fold (*Wulst*). The basal part of the terminal telopodite between the process and

the end of the femur is to be regarded as a fused solænomerite and tibiotarsus.

The spermatic canal bends inwards slightly at the end in the terminal lobe of the solænomerite, but is without trace of a secondary curvature (*Nebenbiegung*) ; the border of the terminal lobe is finely dentate (Pl. viii, fig. 17).

Occurrence.—Upper Richmond River, New South Wales. Collected by R. Helms (April).

2. Paraulacoporus sulcatus *gen. et sp. nov.*

Male 50 × 5 mm. Body brownish black, greyish-yellow on the abdomen, back with rather broad yellowish *median band*, which continues over the pro- and meta-zonites to the telson. Legs black, brownish on the joints.

Head with setæ in front and punctated with scattered pits; three small setigerous pits between the antennal pits. Vertex with a deep furrow, which broadens anteriorly into a sort of groove and is striated with lateral furrows.

Sides of collum rounded and with marginal furrow. Lateral folds of the second to fourth pleurotergites completely rounded in front and behind. Repugnatorial gland pores distributed as usual, exceptionally dense on the lateral furrows, which are curved anteriorly but do not reach the suture. *Among the lateral furrows* on the flanks are several curved longitudinal furrows, which are in part longer, in part of reduced length. Transverse furrows deep, widely separated from the lateral furrows. Sutures finely pearled. Back dull, finely wrinkled in places on the metazonites. The truncated process of the telson with two small points, an emargination between them. The lateral furrows are more and more *reduced in length* and indistinct on the posterior rings, namely, the fifteenth to nineteenth. One can speak of *rudiments* of the lateral folds inasmuch as near the lateral furrows on the outside, especially on the porigerous rings, a slight *swelling* can still be detected.

Femur on the first pair of legs of the male with strong, setigerous process, displaced slightly backwards. Femur and postfemur only slightly arched on the outside. Coxæ of the second pair of legs as in *Walesoma*. The sternite plate, which expands downwards between the coxæ of the fourth pair of legs, much higher than in *Walesoma*, in the basal moiety almost parallel-sided and naked, in the terminal moiety shaped like the segment of a circle and setigerous. The sixth and seventh pair of legs of the male without special features.

The *gonopods* (Pl. vii, fig. 11) on the end of the long femur with two strong, almost equally large, spinous, secondary processes directed endwise, one showing a slender, the other an expanded

base. The somewhat S-shaped terminal telopodite is an extensive fusion of tibiotarsus and solænomerite. About the middle appears a leaf-like bent *expansion*, finely dentate on the edge, the end projecting in an angulated point. In the terminal third the telopodite is divided into the true solænomerite and a *tarsal branch*, which is bifurcated, and hooked backwards at the end. The solænomerite is a broad leaf, with three projections at the end, the median containing the opening of the spermatic canal. The spermatic canal makes a short secondary loop in the basal projection and the terminal projection juts forward in a triangular point. The median expansion may be regarded as a lateral ramus of a post-femoral or tibial segment. This gonopod can also be regarded as a phylogenetic *forerunner* of that of *Walesoma* (Pl. viii, fig. 16), the tarsal branch unrecognizable in both cases; *Walesoma* retains a rudiment of the leaf-like expansion in a small fold (*w*). The farther the solænomerite extends, as in *Walesoma*, the more all the adjacent parts of the gonopods tend to disappear, until finally only the solænomerite remains, as in *Helicopodosoma* and its allies.

Occurrence.—North Dorrigo, New South Wales, collected by Musgrave, 4th January; two males.

SOLANODOLICHOPUS *Verhoeff.*

For purposes of orientation I give for the two new species and the three forms previously described by me, a key based on the principal characters.

(*a*) Body with light or dark *longitudinal bands*. Gonopods either with a longitudinal slit on the terminal telopodite and at the same time without lateral ramus on the end of the femur (*teres* Verhoeff), or without such slit and with two lateral rami on the end of the femur, like *rubriventris* (*vittatus* and *dorsalis* Verh.); in the latter the terminal telopodite has in the middle only *one* lateral ramus and a second shorter one behind the lobe with the opening of the spermatic canal. Solænomerite with the canal opening always tapering to *a slender point*[12] 1-3

(*b*) Body *without* light longitudinal band. Gonopods on the terminal telopodite without longitudinal cleft, the solænomerite forming a *broad* expanding lamella .... *c*, *d*

(*c*) Metazonites with only very fine sparse wrinkles even in the region above the pores. Body *ringed*, the metazonites for the most part dark brown and the prozonites wine red. Terminal telopodite with only *one* broad, trapezoidal, lateral ramus. End of the femur with a small tooth and a larger spine-like process widely separated from it. Solænomerite almost constant in breadth throughout. Coxæ of the second pair of legs of the male projecting forwards on the inside and slightly excavated (Pl. x, figs. 26, 27) .... 4. *walesius* n. sp.

(*d*) Metazonites more distinctly and densely wrinkled, especially on the region over the pores. Back brownish black, without rings, only the abdomen passing into a wine red colour. Terminal telopodite with *two* spine-like, therefore slender, lateral rami. End of the femur with a small peg close to a long lateral branch, which is produced in a spine-like manner. Solænomerite somewhat club-shaped (Pl. x, figs. 24, 25). Coxæ on the second pair of legs of the male projecting upwards on the inside, rounded-triangular on the end but not excavated .... 5. *rubriventris* n. sp.

[12] cp. Verhoeff.—*Loc. cit.*, pp. 20, 21.

SOLANDOLICHOPUS WALESIUS *sp. nov.*

Male 48 × 5 mm., female 48 × 5 mm.

Front of the head with scattered bristles and coarse punctations, sides of the head with longitudinal wrinkles, vertex with a deep median furrow, 3 + 3 small setigerous pits between the antennal pits. Sides of the collum rounded and wrinkled. Lateral edges of the second pleurotergite completely rounded off, third and fourth pleurotergites with curved lateral grooves, the outer edges turned up in a roll (*wulstig aufgeworfen*). Behind the pores of the fifth pleurotergite a short lateral furrow, the lateral furrows completely lacking from the sixth ring onwards, and the lower sides also are without longitudinal wrinkles. Back rather brilliant, also the prozonites, which are very slightly wrinkled. Metazonites with a few scattered wrinkles. Pores large and nearer to the posterior border than to the suture even on the fifth ring, suture finely notched, the transverse furrow deeply incised. Telson process truncated and with two points, with emargination between the points.

The wine-red colour of the prozonites extends on to the anterior bands of the metazonites, which are otherwise dark brown. The lower sides and abdomen are also wine-red, the legs yellowish.

Femur of the first pair of legs of the male with a strongly setigerous process on the inner aspect, strongly arched forward on the outside. Postfemur moderately arched. Second pair of legs as in *Walesoma*, but the three last joints have a dense tuft of hair (in *Walesoma* only on the two last). Plate between the coxæ of the fourth pair of legs as in *Paraulacoporus*, otherwise projecting very far downwards and somewhat forwards, the terminal border rounded-truncate in the middle.

Gonopods (Pl. x, figs. 26, 27) distinguished by a broad, almost trapezoidal, leaf-like, lateral ramus (*a*) in the basal half of the terminal telopodite, which is drawn out into a sharp point. The horn-like bent solænomerite remains almost of the same breadth throughout, is obliquely truncated on the end and runs out into a short blunt process with a small tooth. The spermatic canal makes no accessory loop. Of the two processes on the end of the femur one is small and triangular (*z*), the other large and spinous (*pr.*).

Occurrence.—North Dorrigo, New South Wales, collected by A. Musgrave, 4th January, 1923.

SOLANDOLICHOPUS WALESIUS *sp. nov.*

Male 53 × 5 mm.

Apart from the characters already mentioned this species agrees with the foregoing in its outward form and also in the

structure of the first-seventh pairs of legs in the male. The gonopods (Pl. x, figs. 24, 25) correspond as regards the two processes on the end of the femur (*z* and *pr.*) with those of *vittatus* Verh., yet the longer process on the end is still more strongly produced in a spine-like manner.

The terminal telopodite, on the contrary, is very different in form from that of *vittatus*, and is distinguished by a long solænomerite leaf, which expands in a somewhat club-like manner in the terminal moiety, contains the canal opening on a triangular point on the extreme terminal edge, and near it are several small teeth. The basal half of the terminal telopodite ends on either side in a spinous process (*a*, *b*), and from the longer of these it expands under an obtuse angle, where some short points are found.

Occurrence.—Upper Richmond River, New South Wales, April, one male, three females.

Dicladosoma *Bröl.*, Verh. *char. em.*

The forms which belong here are all very striking on account of their pattern, namely, the light and dark rings of their limbs, which are predominantly dark in colour but light on the ends, and the V-shaped, light, longitudinal stripes on the metazonites. The telson process is truncate and rounded without sharp points or angles. The three forms in front of me are therefore distinguished from one another by the following characters.

(*a*) Tibial segment of the tibiotarsus of the gonopods only slightly excavated terminally, *without* transverse ridge (*Leiste*) and *without* recurved lobes, with simple rounded lobes opposite the end of the solænomerite, the end of the tibia with longish lamella, rounded to triangular in shape, without deep emargination between this and the anterior lobes, so that there is no neck-like constriction. The V-shaped light-coloured metazonite bands are produced on to the prozonites .. 1. *annulatipes* Verh.

(*b*) Tibial segment *very deeply* excavated terminally, with strong *transverse ridge* in front of the solænomerite end terminating in a projecting angle; from this proceeds a *hooked* recurved lobe. End of the tibia without lamella, but projecting in a knob or process. In front of the recurved lobe is a *deep excavation*, so that the basal segment appears to be constricted in a neck-like manner.

× The recurved lobe of the tarsus is *broad* and rounded, the end of the tibia drawn out in a strong process. Coxæ of the sixth pair of legs of the male excavated on the inside of the end and projecting in a blunt *knob*. The V-shaped bands, at least in the posterior half of the body, are *produced* on the prozonites (Pl. ix, fig. 23) .... 2. *andersoni dorrigensis* Verh.

×× The recurved lobe is *narrow*, and opposite to it on the end of the tibia there is merely a humpy protuberance but no process. Coxæ of the sixth pair of legs of the male neither excavated nor provided with a knob. The V-shaped bands of the metazonites are never produced on the prozonites (Pl. viii, figs. 18, 19) .... 3. *andersoni* n. sp.

5. DICLADOSOMA ANNULATIPES *Verhoeff.*

Male 48 × 4½ mm., female 42 × 4½ mm.

This species was described from a single defective specimen lacking the head and the first-sixth rings.[13] After I was able to examine several more specimens, including two complete males, the deficiency could be supplied. But I can refer to *D. andersoni,* for both species agree in the characters of these body parts, and also in the first-seventh pair of legs.

Occurrence.—Upper Richmond River, New South Wales, April, several specimens, including two males, the gonopods of which agree with my figure.[14]

6. DICLADOSOMA ANDERSONI *sp. nov.*

Male 55 × 5½ mm.

Head punctated with scattered pits and bristles, some scattered punctations also in the region between the antennal pits. Sides of the head with coarse longitudinal wrinkles, vertex with deep furrow, from which proceed lateral wrinkles. Sides of the neck rounded, with distinct, somewhat rugose marginal furrow. Lateral edges (*Leisten*) of the second pleurotergite rounded in front, angular posteriorly, but not projecting; lateral edges of the third and fourth pleurotergites rounded in front, with weak triangular points behind; the remaining lateral folds appear triangular when viewed from the outside, with a straight border above, become narrow anteriorly and posteriorly, the pores much behind the middle, somewhat closer to the inferior border than to the lateral furrow. Prozonites dull, metazonites shining, with only very fine wrinkles. Sutures finely pearled, transverse furrows deep, coming rather close to the lateral furrows. The transverse furrows begin on the fifth ring; on the first-fourth they are completely lacking. Lateral furrows strongly curved inwards in front but not reaching the suture; viewing them from the outside one can see that the lateral furrows are curved slightly upwards anteriorly. Flanks under the lateral folds without longitudinal wrinkles.

First pair of legs of the male with a strongly bristled process displaced somewhat backwards, otherwise only slightly curved inwards; femur and postfemur strongly arched outwards. Coxæ of the second pair of legs of the male expanded inwards, projecting like a blunt triangle, the three last joints with dense tuft of setæ, broadest now and then on the tarsus. The downwardly directed plate between the fourth coxæ is particularly high, parallel-sided in the basal half, rounded trapezoidal in the terminal half, 1½ times higher than fourth coxæ are long (in *Paraulacoporus* only as high as the coxæ, in *Walesoma* even lower). Coxæ on the sixth and seventh pair of legs without special features.

The *gonopods* (Pl. viii, figs. 18, 19) are, in comparison with those of *annulatipes*, more deeply emarginated on the end of the

[13] Verhoeff.—*Loc. cit.*, pp. 27-28.
[14] Verhoeff.—*Loc. cit.*, Pl. ii, fig. 16.

solænomerite; on the end of the tibiotarsus appears an exceptionally deep sinuation (*b*), in front of which is a transverse ridge, which runs out into a tooth-like angle (*d*), whilst the terminal lobe likewise projects somewhat angularly, and, by means of an obliquely recurved ridge with dilatation, is united to an uncinate recurved lobe (*c*), which proceeds from the transverse ridge. A triangular lamella (*e*) on the tibiotarsus marks the boundary between the tibial and tarsal segments. The sinuation posterior to this is considerably deeper than in *annulatipes*, so that the tarsal segment appears more strongly defined.

The femoral segment (Pl. viii, fig. 19, *fe*), about as long as broad, is on one side strongly demarcated from the terminal telopodite. Solænomerite and tibiotarsus remain separated from one another almost to the end of the femur.

Occurrence.—Booloombayt, Myall Lakes, New South Wales, 30th August, 1922, two males, collected by A. Musgrave.

7. Dicladosoma andersoni dorrigensis *sub-sp. nov.*

Male $49 \times 4\frac{1}{2}$, $52 \times 4\frac{3}{4}$ mm., female 46×5 mm.

Apart from the differences mentioned above this form agrees with the foregoing species. The *gonopods* (Pl. ix, fig. 23) differ only in the two processes, which are curved against one another in the region of the deep sinuation between the tibial and tarsal segment, the backwardly bent lobe is broader, and opposite to it (instead of the triangular lamella) is a cone-shaped process. In its markings this form is exactly similar to *annulatipes*, as also in the annulation of its legs and antennæ.

Occurrence.—North Dorrigo, New South Wales, 4th January, 1923, collected by A. Musgrave.

8. Hoplatessara musgravei *gen. et sp. nov.*

Male 53×5 mm., female $44\frac{1}{2} \times 5\frac{1}{4}$ mm.

Uniformly black, only the legs of a prevailing yellowish brown, but the last three joints are dark brown. Structure of the head as in *Dicladosoma,* but the vertex furrow is rather more strongly pitted in the middle, and the sides of the head, especially behind the antennal pits, are much more weakly wrinkled. In shape and sculpture very similar to *Dicladosoma,* but the sutures are more strongly streaked, and the transverse furrows are very deep and extend almost to the lateral furrows. The first-fourth pleurotergites are without transverse furrow, the fifth-seventeenth have a deep furrow, the eighteenth one somewhat less deep, the nineteenth and twentieth none. Terminal process roundly truncate without points. Prozonites dull, metazonites shining, both finely wrinkled.

Gonopods (Pl. ix, figs. 21, 22). One the side of the femur, which is $1\frac{1}{2}$ times longer than broad, are two long lanceolate lateral rami

(*pr* 1, *pr* 2), pointed at the ends, the longer pitted and excavated anterior to the end, both shorter than the solænomerite. The long tibiotarsus, which with its roundish club-like termination in great part overlaps the solænomerite, exhibits in front of the club a slight inflection, otherwise there is no variation in section, the long stalk remaining almost uniformly slender till this inflection is reached. Tibiotarsus and solænomerite are separated from one another almost to their bases, the latter bent anterior to the middle in an obtuse angle, S-shaped posterior to this, widening suddenly on the outside into an elongated lobe (*l*) divided into three points terminally. The largest point is recurved and contains the opening (*x*) of the spermatic canal. The two shorter points (*e* and *d*) oppose one another like pincers, and the proximal one contains the sharply-bent end of a long accessory loop of the spermatic canal.

The first-seventh pair of legs of the male are as in *Dicladosoma*, that is, the first pair, especially the femur and postfemur, are strongly inflated, and almost semicircular on the outside.

Occurrence.—Hazelbrook, Blue Mountains, New South Wales, one pair, 24th December, collected by A. Musgrave.

Remark.—The close relationship between *Dicladosoma* and *Hoplatessara* is shown both in bodily shape and in all characters of the male, so that the two could even be united as subgenera.

9. Hoplatessara clavigera *n. sp.*

Male 47 × 4¼ mm.; is distinguished from the foregoing as follows:

H. musgravei.	H. clavigera.
Back uniformly black, legs light in colour, but the two terminal joints blackish. Sternite plate between the fourth coxæ almost parallel-sided basally, almost circular terminally. Gonopod solænomerite *more than twice* as long as the distance between its base and the root of the femoral lateral ramus. Tibiotarsus with only the end half of its club extending beyond the solænomerite, the latter very strongly developed (Pl. ix, fig. 21). Of the lateral rami of the femur only the longer has 1-2 excavations in front of the point. Tibiotarsus almost *straight* in the basal half. Solænomerite bulging out on the inside posterior to the middle. The accessory loop of the spermatic canal is long, sharply folded down, and reaches almost to the point of the median terminal process (Pl. ix, fig. 22).	Back reddish brown, the metazonites straw yellow behind the transverse furrow, legs quite white. Sternite plate between the fourth coxæ taper from the base onwards in a trapezoidal manner, the terminal joint rounded-obtuse. Gonopod solænomerite (Pl. xi, fig. 28) only slightly longer than the distance between its base and the root of the lateral ramus of the femur. Tibiotarsus extending about as far beyond the solænomerite as this is long. Strongly *bent* twice in the basal half. Solænomerite not so strongly developed, without any bulge on the inside. On the two lateral rami of the femur (Pl. xi, figs. 28, 29) there is a whole row of excavations in the terminal half so that they seem divided into compartments, and notched and tubercled on the outside. The accessory loop of the spermatic canal (Pl. x, fig. 30) is developed only as a short curve without sharp angle and without sinking into the median terminal process.

In other respects *H. clavigera* agrees with *musgravei,* but the forehead between the antennal pits is more strongly rugose, also the dorsal surface of the body and especially of the collum is more densely wrinkled and less shining. Transverse furrows are still more deeply incised and without notches; on the eighteenth segment they are strikingly deeper than in *musgravei.* The first-eighth pairs of legs of the male are quite similar to those of *musgravei.*

As regards the gonopods I call special attention to the fact that the femur is extremely short; the solænomerite, apart from the differences already mentioned, is very similar to that of the foregoing species, and almost exactly similar in the three terminal processes, only the middle one (*d*) is not so close to the distal, and the proximal (Pl. x, fig. 30, *x*), with the seminal opening, is still more delicate. Lateral rami of the femur are throughout closely applied to the tibiotarsus.

Occurrence.—This species, which evidently comes from New South Wales, I received for examination from the Zoological Museum of Stuttgart. A more exact locality is, unfortunately, not known.

10. Leucotessara lucida *gen. et sp. nov.*

Male 40 × 5 mm.

Body yellowish white with narrow, yellowish brown striæ on the transverse furrows, on the posterior borders of the metazonites, the median portion of the latter, and in part also inwards from the lateral folds, which are completely rounded. Collum with three brown longitudinal bands, of which the middle one is the broadest. Head with broad brown band along the forehead, which sends out a narrow band behind the antennal pits. Legs yellowish white. Lateral folds of the second-sixth pleurotergites completely rounded anteriorly and posteriorly, sides of the collum rounded and with a rather broad margin. Vertex with an incised median furrow, extending as far as the forehead, separating two small *bosses* on the forehead. This and the region behind the antennal pits strongly rugose.

Repugnatorial pores large, with typical distribution, about median between the lateral furrows and the inferior border of the lateral folds. Lateral furrows curved inwards in front, but remaining a good distance from the strongly streaked sutures. Transverse furrows unusually deep and even slightly indented (*gekerbt*). Metazonites smooth and brilliant, slightly rugose, prozonites dull, almost without sculpture. Telson process truncate, without projecting angles.

On the femur of the first pair of legs of the male is a strong, setigerous process, but femur and postfemur are but moderately arched outwards. The sternite plate between the coxæ of the

fourth pair of legs tapers trapezoidally, the last third with rounded obtuse-angled termination. Coxæ of the sixth and seventh pair of the male expanding inwards in a rounded protuberance. Between the coxæ of the tenth pair there are no processes. Coxæ of the second pair rounded on the inside, forming triangular projections.

The gonopods (Pl. ix, fig. 20) are most like those of *Hoplatessara*, but they show such differences that a generic separation appears to be justified. The femur is extremely short, and on its side are two lanceolate lateral rami, of which the longer (*pr* 2) is more slender and of a pale glassy consistence; the shorter is stouter and yellowish. Tibiotarsus and solænomerite are separated from one another except for a short distance basally. Special attention has already been called to the tibiotarsus, with its evidently primitive segmentation into tibia (tt_1), tarsus (tt_2) and ungulum (*c*). The tarsus rests with a *stalk-like base* on the tibia, and near the stalk the tibia extends endwise into a rounded lobe. On the outside near the stalk is an exceptionally strong constriction. The tarsus is exceptionally broad in comparison with the solænomerite, and rests like a mighty club on the tibia. On its end is a rounded cap, which is strongly hooked opposite to the solænomerite; in front of the hook the tarsus has a projecting point. The solænomerite is also club-like, and is strongly inflated, especially in the middle; it is bent in an S-shape, expands outwards in a lamelliform manner in the terminal third, and is bent somewhat hook-like at the end. The spermatic canal pursues a quite simple course, *without* any indication of an accessory loop.

Occurrence.—Duggan's Gully, Upper Chichester, New South Wales, one male, 21st September, collected by A. Musgrave.

11. MYALLOSOMA HAMULIGERUM *gen. et sp. nov.*

Male 35 × 4 mm.

Body predominantly brown on the sides, with broad *yellowish white longitudinal bands* on the back, but with a brown transverse band on the posterior border of the tergites. Abdomen and legs reddish yellow. Head mostly smooth. The fine furrow on the vertex extends forward to between the antennal pits, and between these are two small setigerous pits. Sides of the collum in front with deep marginal furrow which arches over the lateral lobes. Lateral folds of the second pleurotergite projecting in grooved ribs (*ausgehöhlte Rippen*) which are somewhat angular in front, and posteriorly are produced, and are indeed stronger and more pointed than in the otherwise similar *Rhopalowales clavigera*. Lateral folds of the third and fourth pleurotergites produced posteriorly in short triangular points. The remaining rings have lateral furrows and lateral folds, the latter projecting backwards as rounded lappets. Pores closer to the lower surface of the lateral folds than to the lateral furrows. Suture pearled and notched. Lateral furrows

strongly curved inwards in front, but they do not reach the suture. Nor do the deep transverse furrows reach the lateral furrows. Prozonites dull, metazonites smooth and brilliant; the former are very finely and densely punctate, the latter slightly and sporadically rugose. Telson process broad and truncate, without points or angles.

Femoral process of the first pair of legs of the male is displaced against the posterior side, hence it is only partly visible from in front; it carries bristles and is moderately large. Femur is strongly expanded outwards, the post-femur only slightly arched outwards in front. Sternite plate between the coxæ of the fourth pair of legs almost semicircular, but on each side it is slightly indented two or three times, and is strongly bristled in the terminal half. Coxæ of the sixth and seventh pair without expansion inwards. Sternite of the tenth pair of the male with two longish, rather widely separated *protuberances* between the coxæ, projecting inferiorly (*nach unten abstehende*).

Gonopods (Pl. vii, figs. 12, 13) are in many respects similar to those of *Rhopalowales;* for example, in the partial fusion of the tibiotarsus and solænomerite and the structure of the latter, but the fusion of the tibiotarsus and solænomerite is still more extensive and extends almost to the middle of the terminal telopodite (*b*). Femoral segment decidedly longer than broad, on its end a lateral ramus of very peculiar shape, being constricted at the base, and divided into two processes in the middle, one longer, directed endwise, slender and uncinate (*pr*), the other (*pr*2) shorter, standing off obliquely, rounded-triangular, dentate on the outer margin, and also uncinate on the end. The terminal telopodite (*Resttelopodite*) falls into two halves, namely, a terminal segment formed by the separated portions of the solænomerite and tibiotarsus, and a similar basal segment between the beginning of the division (*b*) and the end of the femur. This basal part is again divided by a constriction (*y*) into a narrower stalk and a broader bulging terminal portion. The *stalk* I regard as a postfemur.

The tibiotarsus is sickle-shaped, but at the same time broad and leaf-like, dentate on the broad end and obliquely truncated, the terminal arch turned up longitudinally *into a fold* on the solænomerite side (Pl. vii, fig. 13, *w*), the fold falling away towards the truncated end. The solænomerite is *bifurcated* into a short and broad branch (sl_1) in which the spermatic canal opens, and a longer branch (sl_2) tapering to a point, traversed for its entire length by the long accessory loop of the spermatic canal, which finally doubles back in a sharp turn. The spine-like accessory branch clings closely to the tibiotarsus, and therefore, in correspondence with the latter, it makes a cornuate curve. The shorter solænomerite branch is broad and somewhat uncinate; it is only a short distance from the end of the longer process on the lateral ramus of the femur.

Occurrence.—Myall Lakes, New South Wales, one male, 30th August, 1922, collected by A. Musgrave.

Remark.—As regards its gonopods *Myallosoma hamuligerum* is somewhat reminiscent of "*Australiosoma*" *kosciuskovagum* Bröl., but a closer comparison is rendered very difficult, as in Brölemann's figure the course of the spermatic duct is not clearly discernible. In any case this form is sharply distinguished from Brölemann's, for the latter has a simple spine-like lateral ramus of the femur, which Brölemann designates *tb* in his illustration.[15]

12. Rhopalowales clavirera *gen. et sp. nov.*

Male 46 × 4 mm., female 35½ × 4 mm.

Dark brown, with broad, dull grey median stripes on the back, the lateral folds and flanks thereunder likewise lighter in colour, legs yellowish, second and third terminal joints darker. With lateral furrows and lateral folds, the latter projecting posteriorly in small but distinct angles, the former curved inward in front but not reaching the suture. Sutures very distinctly notched, the deep transverse furrows a good distance from the lateral furrows, well impressed on the fifth-seventeenth rings, weaker on the eighteenth and wanting on the remainder. Pores widely distant from the posterior end of the lateral folds, in the middle between the inferior border of the latter and the lateral furrow. Metazonites rugose. Viewed from the outside the lateral folds appear broad in front, and posteriorly tapering gradually to a conical point. Lateral folds of the second pleurotergite project in short points, of the third and fourth in a somewhat angular manner. Telson with broad truncated process, which projects only slightly on the corners of the truncation.

Femur of the first pair of legs of the male with strongly setigerous process, femur and postfemur somewhat strongly arched outwards. Coxæ of the second pair expanded inwards and projecting in a rounded knob. Sternite plate between the coxæ of the fourth pair of legs reaching considerably beyond the coxæ, tapering trapezoidally, rounded off in a broad arc terminally, setigerous in the terminal half, a division (*Absetzung*) on the sides behind the basal third. Coxæ of the sixth and seventh pairs simple. *No* sternal process between the coxæ of the tenth pair.

Gonopods (Pl. viii, figs. 14, 15). As already mentioned these in many respects resemble those of *Myallosoma*. But the prefemur (in distinction to the roundish prefemur of *Myallosoma*, which terminates transversely against the femur) is here considerably produced and obliquely wedge-shaped exteriorly as well as interiorly and its end is pushed forward, so that *femur and prefemur are pushed against one another like triangular wedges.* The setigerous

[15] Brölemann.—Rec. Austr. Mus., x, 6, 1913, pl. xv, fig. 18.

prefemur region *reaches to the base of* the femoral *lateral ramus*, while in *Myallosoma* it is widely separate therefrom. Thus one can say, shortly, that the prefemur and femur of the gonopods lie *behind* one another in *Myallosoma*, in *Rhopalowales*, on the contrary, *alongside* one another. *Rhopalowales* is distinguished, in general, from all other strongylosomid genera described here by the sharply projecting wedge-shaped prefemur.

The femoral lateral ramus (Pl. viii, fig. 14 *pr*) extends almost as far endwise as the solænomerite; it is bent in a slight S-shape, maintains about the same breadth and has a somewhat club-like terminal thickening. Tibiotarsus and solænomerite are fused for only a short distance at the base, that is, behind the root of the femoral lateral ramus. The tibiotarsus (*tt*) has a very characteristic shape; in the middle is a nearly right-angled bend, then it is stalk-like, and terminally it is clubbed and at the same time spoon-shaped opposite the opening of the seminal duct. On the extreme end it projects in a blunt tooth-like process. The solænomerite (Pl. viii, fig. 15) strongly recalls that of *Myallosoma*, but is clearly distinguished by the fact that between the two branches a broad rounded-off lobe (*lo*) is inserted, and the latter is excavated on the inside. The branch (*sl*) which contains the opening of the seminal duct is bent in a somewhat uncinate manner and is turned backwards. The lobe (*lo*) is connected to this by a strongly bent, finely dentate, and delicate lamella. The other forwardly projecting branch (sl_2) tapers off into a spine, and is traversed for its whole length by the accessory loop (*u*) of the seminal duct, which bends back suddenly near the end.

Occurrence.—Nowra, New South Wales, 21st April, 1905, two males, one female, of which one had just moulted, the other two being somewhat beyond that stage. All three are therefore more or less soft and showed a false rugosity. On this account I am unable to give any trustworthy details regarding the structure of the back.

III. Spiroboloidea.

Whilst the Spiroboloidea seem to be entirely absent from Western Australia, at least according to the investigations of Hartmeyer and Attems,[16] they occur everywhere in Eastern Australia, as proved anew by the following contribution, and they manifestly form an important contingent of the Diplopod fauna. Hitherto, however, these, especially the smaller forms, have been the least known.

I have already provided a key for six Australian Spiroboloid genera.[17] Since in the following account two new genera are described, I give here a new key but in abbreviated form.

[16] Attems.—In Michaelsen u. Hartmeyer, Fauna Südwest Australiens, iii, 6, Jena, 1911—Myriopoda.
[17] Verhoeff.—*Loc. cit.* pp. 99-101.

Key to the Australian Spiroboloid genera.

A. Posterior gonopods *without* distinct jointing. Sternites of the anterior gonopods triangular-trapezoid, or semicircular, not projecting in a long process. Body without scobinæ.

(*a*) Pores of the repugnatorial glands *close behind* the obliterated sutures, body without longitudinal stripes, telson with short process. Coxæ of the third-fifth pair of legs of the male produced into long terminal lobes (Pl. x, fig. 32). Sternite of the anterior gonopods trapezoidal projecting in a triangle at the end, the triangle covered with warts. Telopodite of the anterior gonopods *not* cleft (Pl. x, fig. 31). Coxites divided into *three* regions. Posterior gonopods (Pl. x, fig. 34) bent in a sickle shape, but without sudden contraction behind the basal third, and *without* a sudden expansion in front of the terminal third, with a lateral ramus inside in the middle .... 1. *Walesbolus* g. n.

(*b*) Pores of the repugnatorial glands *far behind* the sutures .... *c*, *d*

(*c*) Telopodites of the anterior gonopods *cleft into two halves* up to half their length. Posterior gonopods bent *hookwise* and with accessory lobes posterior to the middle. Preanal segment without process, body of a light ground colour, with black longitudinal stripes, 2 + 2 labral pits .... 2. *Attemsobolus* Verh.

(*d*) Telopodites of the anterior gonopods *not* cleft. Labrum with several indistinct pits .... *e*, *f*

(*e*) Posterior gonopods behind the basal third with sudden expansion inward in the form of steps, and likewise suddenly expanded inwards anterior to the terminal third. Preanal segment *without* process. Coxites of the anterior gonopods either divided by a deep emargination into principal and accessory portions, or such division is at least indicated by a slight sinuation.

× Body *without* longitudinal stripes. Sternite of the anterior gonopods almost semicircular, somewhat crenate (*eingeschnitten*) on the terminal margin, with large parallel-sided cushions posteriorly. Main portion of the coxites of the anterior gonopods projecting *equally as far as* the telopodite, the latter not divided into segments; the main coxal portion is divided from the accessory portion by a deep sinuation. Terminal third of the posterior gonopods triangular, and running out into a spine .... 3. *Queenslandobolus* Verh.

×× Body *with longitudinal stripes*. Sternite of the anterior gonopods projecting triangularly at the end, with a triangular tapering ridge posteriorly. Main portion of the coxites of the anterior gonopods *falls much short* of the telopodite, and is separated from the accessory portion by a shallow sinuation only. The telopodite is divided into two sections by a constriction. Terminal third of the posterior gonopods hatchet-shaped and broad .... 4. *Howeobolus* g. n.

(*f*) Posterior gonopods bent sicklewise, without sudden expansion either posterior to the basal third or anterior to the terminal third. Preanal segment with a short *process*. Coxites of the anterior gonopods not divided into two segments by emargination, therefore in general consisting of two instead of three regions, the main portion produced into a conical end process; telopodite forming a broad thumb-like termination without median constriction, but on one side there is a median obtuse-angled sinuation. Sternite of the anterior gonopods similar to that of *Howeobolus*. Body without longitudinal bands .... 5. *Poratobolus* Verh.

B. Posterior gonopods decidedly *two-jointed*. Sternite of the anterior gonopods projecting in a *process*. Pores of the repugnatorial glands *in* or mostly *in front of* the sutures.

(*a*) Sides of the collum broad, forming a rounded right to obtuse angle. Sternite of the anterior gonopods consisting of a broad triangular basal portion and more slender process. Posterior gonopods elongated, *without* inflexion.

× Posterior gonopods divided into *two* branches. Anal valves depressed in a dimple longitudinally near the inner margins, or at any rate above near the posterior angle, so that the inner margins appear more or less *pad-like* (*wulstig*) .... 6. *Dinomatocricus* Bröl.

×× Posterior gonopods *without* accessory branch, therefore simple. Anal valves uniformly arched, at most with indications of weak impressions, or compressed on the inside along their length .... 7. *Adelobolus* Verh.

(*b*) Sides of the collum narrow triangular, projecting under an angle of 45° to 70°. Sternite of the anterior gonopods consisting of *broad process* and narrower basal portion. Posterior gonopods consisting of coxites and telopodites, which appear *sharply inflected against one another* .... 8. *Trigoniulus* Poc.

WALESBOLUS LOBATUS *gen. et sp. nov.*

Female 41 × 4½ mm. with 87 pairs of legs, only the telson apodous; male 41 × 3⅝ mm., with 87 pairs of legs, 50½ × 4 mm. with 93 pairs of legs.

Body black, only the posterior margins of the rings with narrow light-coloured areas, legs reddish yellow. Sutures of the diplosomites for the most part obliterated, also on the lower part of the sides, where they are most distinct, they are not furrow-like, yet with certain lighting they are also indicated on the back. Gland pores close behind the sutures. Antennæ with four olfactory cones, lâbrum with several small shallow pits on each side. Ocelli 2, 4, 5, 6, with rather flat but distinctly differentiated cornea lenses. Head smooth, with a few fine striated (*geritzte*) furrows between the antennæ. Duplomentum with several irregular transverse furrows in the posterior half.

Collum predominantly smooth, with *rounded-truncate* lateral lobes and deep marginal furrow, which bends over at a right angle on the lateral lobes. Metazonites of the body mostly without furrows, with rather numerous and somewhat irregular longitudinal striations on the under part of the sides in the region of the legs. On the prozonites in the inferior half of the region below the pores there are grooves which trend very obliquely forwards and upwards and finally quite upwards. Pleurotergites less shining and with very fine, striated, longitudinal wrinkles on prozonites and metazonites. Preanal segment with short rounded off process extending only slightly over the anal valves. The anal valves smooth and regularly arched, without impressions.

On the first pair of legs of the male the coxæ are separated for half their breadth, on the second pair the coxæ are in close contact for their entire length, only the penes separated for a short distance at the end, these segments separated for only half their breadth,

the end rounded and obliquely truncated on the outside. Coxæ of the third to fifth pair of the male with broad, rounded, humpy process (Pl. x, fig. 32) extending beyond the prefemur. On sixth and seventh pair this is low and does not extend beyond the prefemur. On the third to seventh pairs of the male the end of the coxæ are broad and rounded off, and therefore the telopodite is displaced far outwards, and all the telopodite segments are quite glabrous inside and outside, only the tarsus having a few setæ on the end. Pads are not present (*Polster fehlen*).

The gonopods (Pl. x, fig. 31) show again the division of the coxites into three segments, of which I have previously spoken.[18] The telopodite then includes the small median, and the large main segment (co_3). The telopodite which extends rather far beyond the latter is only slightly tapered towards the obliquely truncated end, which is excavated on either side; on the whole it is almost S-shaped. The main coxal segment is very broad, rounded off in an arch on the outside, excavated on the inside, and carries numerous warts of varying sizes on the terminal region; some of these are strong and peg-like. One of these pegs (Pl. xi, fig. 33) projects free outwards behind the excavation. The sternite of the anterior gonopods resembles that of *Poratobolus*,[19] but the projecting broad terminal lobe is covered with numerous warts. The curved sickle-like *posterior* gonopods (Pl. xi, fig. 34) have a broad trench-like excavation along their length, broaden gradually in the lower third near the base, carry on the inside a bidentate lateral ramus in the middle, and in the terminal third, which tapers gradually, are ornamented with very fine transverse striations. The extreme truncated termination ends in a very pale point. In front of the transversely striated termination runs an oblique fold (*Wulst*).

Occurrence.—Several pairs from Port Stephens, Fingal's Bay, New South Wales, 24th August, 1920, collected by A. Musgrave.

HOWEOBOLUS INSULARUM *gen. et sp. nov.*

Male 28½ × 2⅓ mm., with 79 pairs of legs and two apodous terminal rings; female 29 × 2½ mm., with 89 pairs of legs and two apodous terminal rings. Orange yellow, with three black longitudinal bands, one narrow median and two broad lateral, in the neighbourhood of the gland pores; telson orange yellow, only the preanal segment with dark, dorsal, transverse bands. Legs yellowish.

Labrum with a scattered group of small pits and longitudinal rugæ on either side. Forehead with transverse curved striæ, and with small pits between the eyes. Vertex with short longitudinal pit produced in lines on each side.

[18] Verhoeff.—*Loc. cit.* p. 95.
[19] Verhoeff.—*Loc. cit.* pl. iv, fig. 64.

Ocelli 1, 3, 4, 5, 7. Collum with rounded-truncate sides and deep marginal furrow, which extends backwards on the lateral lobes in flat curves.

Pores far behind the sutures; the sutures are, however, obliterated to such an extent that their position is, for the most part. doubtful: only with certain lighting can they be recognized on the lower part of the sides as shallow even depressions. On several rings, however, pseudo-sutures can be recognized on the back, sometimes more, sometimes less distinct, lying in the region of the metazonites behind the pores. Metazonites with distinct but somewhat diffuse *longitudinal striations,* which *extend almost to the pores.* This longitudinal striation is continued, for the most part, on the prozonites, forwards, then obliquely upwards to the level of the foramina. The back between the pores on the prozonites with sporadic pits and *curved rugæ.* The latter are in part arranged in transverse rows, and therefore indicate a continuation of the sutures. Metazonites on the back irregularly rugose. Preanal segment completely rounded behind, finely rugose. Anal valves evenly arched, without impressions. Antennæ with four olfactory cones. Duplomentum with only two transverse furrows in the posterior half. Stipites with four to five oblique lines posteriorly.

Coxæ on the first and second pairs of legs of the male as in *Walesbolus,* on the third to fifth pair with slight forward arching, which does not extend beyond the prefemur, otherwise very broad, so that the prefemur is pushed far outwards (Pl. x., fig. 37). The coxæ of the sixth and seventh pair of legs similar, but almost without arching; on third-seventh pairs the telopodite segments are bare on the outside, on the inside, at the most, with single bristles, with more on the tarsus only.

Sternite of the anterior gonopods projecting triangularly on the terminal margin in the middle, the point of the triangle rounded-rectangular, the lateral angles passing into the remainder of the terminal border under an obtuse angle, a triangular cushion behind, the point running out in a ridge-like manner at the end of the triangular projection.

The *anterior* gonopods (Pl. x, fig. 35) are particularly distinguished by the *telopodite,* which is divided on both sides in the middle segments (joints) by a constriction. Outwardly this division is emphasized by the presence of two short transverse furrows, enclosing a groove which can be interpreted as a vestigial joint. The two segments of the telopodite are of about the same size; the oval terminal segment (*te*$_2$) extends for its entire length beyond the exceptionally short *coxite.* On the latter the main portion is broadly rounded off, and carries a few small warts, and is marked off by a slight sinuation from the median part of the coxite, which projects but little.

On the sickle-shaped *posterior* gonopods (Pl. xi, fig. 36) the basal and terminal thirds project suddenly and strongly beyond the median portion; the basal third projects at an obtuse angle. The hatchet-shaped expanded end is swollen in front of the terminal border, sinuated on the inside, and near the sinuation it projects angularly on both sides. The middle part is deeply sinuated on the inside anterior to the centre. A broad longitudinal groove transverses the median and terminal part, and in this region also is a very fine and close striation, which does not extend to the edges.

Occurrence.—One male, one female, from Lord Howe Island, about 300 miles east of Port Macquarie, New South Wales, collected by R. Baxter.

ATTEMSOBOLUS DORSOVITTATUS *n. sp.*

Female 26-27 × $2\frac{1}{4}$-$2\frac{1}{3}$ mm., with two apodous terminal rings.

Body black, with two broad, orange-yellow, longitudinal bands at the level of the foramina, a little narrower than the broad, black, median, longitudinal band, the posterior borders with a narrow yellowish band, the legs greyish yellow.

Labrum with 3 + 3 small pits, antennæ with four olfactory cones, head smooth and shining, without median furrow, ocelli 2, 5, 6, 6; sides of the collum rounded-truncate, with a strongly curved marginal furrow; collum otherwise smooth and shining. Pores of the repugnatorial glands very small, situated far behind the sutures, which, indistinct in themselves, are distinguished by a *row of pits*, which traverses without interruption not only the lower part of the sides but also the back.

Metazonites with longitudinal furrows only in the region of the legs, prolonged on to the prozonites, the furrows curving somewhat upwards on the latter. Such prozonite furrows are also developed on the upper part of the sides (where metazonite furrows are wanting) almost to the level of the pores. Pleurotergites are otherwise shining and almost devoid of sculpture. Telson entirely without process, smooth and brilliant. Anal valves arched and without impressions.

This species is distinguished from *bivittatus* Verhoeff—

1. By the orange-yellow longitudinal stripes on a black ground.

2. By the transverse rows of pits, which extend over the whole back and mark the sutures.

3. By the 3 + 3 small labrum pits.

Occurrence.—Only two females from the Upper Richmond River, New South Wales (April) are before me. Despite the absence of the male I have no doubt that this species also belongs to *Attemsobolus*, for in size, form, colouring, and sculpture it agrees closely with *bivittatus*.

TRIGONIULUS *Pocock*.

Key to Australian species.

(*a*) Corneal lenses of the ocelli (which are arranged mostly in six rows) *strongly convex*. Sides of the collum rugose. Head, collum, and telson *not* distinguished by contrasting colours.

× Anal valves arched, with only an indication of a longitudinal impression on the inside; sutures below the pores *not* indented (*gekerbt*), moreover, the prozonites exhibit fine scratched (*geritzte*) furrows which ascend obliquely, partly as prolongations of the metazonite grooves. Back closely rugose and punctate between the gland pores, most strongly on the prozonites. Preanal segment intricately rugose, forehead and vertex not very shining, irregularly wrinkled. Terminal lobe on the telopodite of the posterior gonopods rounded off and closely adpressed to the swelling in front of it................ .... 1. *insculptus* Verh.

×× Anal valves with deep pit-like depressions on the inside, the pits exceptionally wide above. In front of the sutures, under the pores, is a row of short grooves, which appear *indented*. Prozonites without oblique furrows, and in general the metazonite grooves are not prolonged. Back without close punctation between the pores, *with a transverse row* of *pits* only, exactly between the pores, otherwise finely rugose, but only sparsely punctate. Preanal segment with only traces of rugosity, except for a very fine punctation. Forehead and vertex predominantly shining, with only a few fine scratched lines. On the telopodite of the posterior gonopods the rounded-off terminal lobe is separated from the swelling in front of it by a triangular sinuation. The swelling is without warty border .... *digitulus* Bröl. (Compare *digitulus richmondanus* m. below.)

(*b*) Corneal lenses either flattened and smooth, or in general without distinct boundaries between them .... *c*, *d*

(*c*) Corneal lenses of the ocelli, which are arranged in seven rows, are flattened and smooth, but nevertheless are sharply separated from one another. Head, collum and telson are *not* distinguished by contrasting colours. Sides of the collum wrinkled. Anal valves arched, with shallow longitudinal impressions on the inside, but only in front. Sutures below the pores *indented*. Prozonites without oblique furrows. Preanal segment with pit-like impressions on each side in front of the obtuse-angled projection. Forehead and vertex as in *digitulus*. On the telopodite of the posterior gonopods, the terminal lobe has two projecting angles (Pl. xii, fig. 38, *e* and l_1) and is separated by a quadrangular indentation (*a*) from the very warty swelling (*w*) in front of it .... *montium* sp. n.

(*d*) The corneal lenses of the ocelli are *blended* in a plane, and are therefore not clearly distinguishable. Sides of the collum smooth, head capsule smooth and brilliant above. Below the pores in front of the suture is a row of pits or short lines, which are continued on to the lower part of the sides in fine, scratched, oblique furrows. Head, collum, and telson distinguished from the rest of the body by their lighter colour.

× Ocelli in three to four rows. Body black; head, collum, and telson orange-yellow. Anal valves arched, smooth, and brilliant, almost devoid of sculpture, only somewhat impressed below on the inside. Punctation and rugosity very fine. Young male (last stage) with 87 pairs of legs .... 4. *hemityphlus* Verh.

×× Ocelli in six-seven rows. Body reddish-brown, with narrow, reddish-yellow rings on the posterior border. Head, collum, and telson greyish-yellow. Anal valves and preanal segment finely and reticulately rugose, the former arched and with a broad, flat, and pitted impression in front only. Female with 97 pairs of legs .... 5. *hebes* sp. n.

TRIGONIULUS MONTIUM *sp. nov.*

Male 72 × 5 mm., with 109 pairs of legs, only the telson apodous. Body greyish-black, the posterior borders with brown rings, legs yellowish-brown. Ocelli 34 (4, 6, 6, 6, 5, 4, 3), with very flat, depressed, but sharply bounded corneal lenses. Antennæ with four olfactory cones. Labrum with 2 + 2 large pits, or deep grooves in the middle. Vertex and forehead rather brilliant, with scratched transverse furrows at intervals, a median furrow on the vertex and impressed again in front between the antennal pits. The triangular lateral lobes of the collum rugose and with sporadic punctations, somewhat truncate terminally, their margins forming an angle of about 60° externally, a deep furrow behind the anterior margin.

Body on the whole *dull*. Actual sutures developed only on the under part of the sides as fine ridges (*Leiste*), and the longitudinal furrows on the metazonites extend as far as these, therefore to the region of the legs; these longitudinal furrows are continued on the prozonites as irregular curved grooves, rising upwards and forwards. Finely punctate between the grooves. On the upper part of the sides the furrows are obliterated except for isolated traces, but a row of curved streaks or pits forms a continuation of the suture. On the back the continuation of the sutures is more or less recognizable as fine structure lines. Prozonites with numerous punctations and pits, of which many are elongated. Metazonites predominantly with fine longitudinal wrinkles. The large pores are distinctly in front of the suture. Telson without process; preanal segment finely rugose, the anal valve arched and with only pit-like impressions.

Coxæ of the third and fourth pairs of legs of the male (Pl. xii, fig. 39) with strong club, extending well beyond the prefemur, and rounded at the end; its neck is only half as broad as the club. Prefemur with straight border on the inside, femur sinuated on the inside and excavated in a channel-like manner. On the fifth pair also the coxæ project in a broad process, with a rounded-truncate termination but not club-shaped and therefore with no basal neck. Femur excavated on the inside and furrowed. Coxæ of the sixth and seventh pairs similar to those of the fifth, but the broad coxal process is shorter; on the sixth truncate, on the seventh rounded off.

The long process *on the sternite* of the anterior gonopods tapers conically in the basal half, is slightly constricted behind the middle, and is broadly rounded-truncate at the end. The head of the

process, which is demarcated by a transverse suture, is almost twice as long as broad. Coxites of the anterior gonopods with broad rhomboidal base, produced into a long, thin, and almost pointed, slightly curved process.

Telopodite consists of two branches, which, however, are so closely apposed to one another that their separation is recognized only on close inspection or in preparation. The *main* portion of the telopodite consists of a triangular base, broadly seated on the *coxite* and produced into a long bent process. The lateral ramus is closely adpressed to the main portion throughout its whole length, so that it, too, is produced into a long process, which lies close on the process of the main portion and projects equally as far; it is bent almost into a sickle shape, but its base is only half as broad as that of the main portion. It rests somewhat broadly and obliquely on the base, only slightly distal from the base of the main portion.

On the posterior gonopods the coxites correspond with those of related species as regards their structure and connection with the telopodites. The telopodites (Pl. xii, fig. 38) are distinguished by a terminal lobe divided into three parts, and two of these project in angles (e and l_2), while the middle one is simply rounded. A deep quadrangular indentation (a), the edge of which has a fine accessory lamella, separates the terminal lobe from an elongated *swelling*, which contains the termination of the seminal duct (x), and is for the most part thickly covered with warts (w, w_1). The naked end of this swelling projects in a short process. Between the swelling and the gradually broadening base of the telopodite lies a deep sinus (b). There is no porigerous area on the expanded inner base.

Occurrence.—The only specimen available for study is a male from Hazelbrook, Blue Mountains, New South Wales, 24th December, collected by A. Musgrave.

TRIGONIULUS HEBES *sp. nov.*

Female 60 × 5¼ mm., with 97 pairs of legs, only the telson apodous.

Ocelli 29 (3, 4, 5, 5, 5, 4, 3), with strongly flattened corneal lenses, and with indistinct boundaries, particularly on the outside, the whole mass smaller than in the preceding species, and therefore separated behind from the collum by a broad stripe, whilst in the former it extends as far as the collum. Terminal joint of the antennæ with four olfactory cones.

Body reddish-brown, head, collum, and telson greyish-yellow, posterior border of the rings with a narrow strip of reddish-yellow, legs yellowish.

Lateral lobes of the collum triangular-rounded, distinctly but shallowly emarginate in front, with furrow behind the anterior margin, the sides of the triangle including an angle of about 50°. Sides of the collum smooth.

Forehead and vertex smooth, posterior part of vertex rugose. Gland pores large, situated somewhat forward of the sutures, the actual pores in a rounded hollow. Dorsal surface with fine punctation and longitudinal striæ, likewise the prozonites and the anterior half of the metazonites, whilst the posterior half of the latter is nearly smooth and therefore shining like the remainder of the dorsal surface.

Sutures distinct as far as the pores, obliterated above. Longitudinal furrows of the metazonites only on the lower sides, but extending somewhat over the region of the legs, continued on the prozonites in oblique and (especially below) closely crowded grooves. Sutures below the pores with small pits which are continued in front in oblique furrows, also in the area of the upper sides, whilst the metazonites show no longitudinal furrows in that region. Anal valves arched with impression quite in front only, with fine reticulated wrinkles, which occur on the preanal segment also, and very finely punctate between the wrinkles.

Occurrence.—Upper Richmond River, New South Wales, April; adult female and a young male of 49 × 3¾ mm., with gonopodal anlage which reveals all the principal parts of the copulatory apparatus, that is, sternite, coxite, and telopodite of the anterior gonopods, as also unjointed posterior gonopods, but nevertheless it exhibits no special features. The anlagen of posterior gonopods take the form of two longish scales in contact in the middle line and extending upwards just as far as the telopodites of the anterior gonopods; the coxites are, however, very low, likewise the triangular, forwardly projecting, incompletely demarcated sternite.

TRIGONIULUS DIGITULUS RICHMONDANUS *sub-sp. nov.*

Male 70 × 4¾ mm., with 107 pairs of legs, only the telson apodous; young male 65 × 4½ mm., with 105 pairs; female 70 × 5¼ mm., with 105 pairs of legs, containing eggs apparently ready for extrusion; female 74 × 5¼ mm., with 105 pairs; young female 40½ mm., with 89 pairs, 7 apodous terminal rings.

The sutures on the dorsum above the pores become more indistinct inwards. Sculpture of the body rings almost as in *digitulus* Bröl., but the transverse series of small pits on the back between the pores are weaker. Apart from this, the form differs from *digitulus*—

1. By the more strongly pointed end of the sternite process of the anterior gonopods, and therefore by the fact that the terminal

part of the telopodites does not extend outwards in an essentially (*am Grunde*) triangular form.

2. On the posterior gonopods (Pl. xii, fig. 40) the terminal lobes (*e*) are more broadly rounded, but the longitudinal pad (*Längswulst*) (*w*) in front of the same has a deep pit (*fo*) and in front of this a very finely setose region. Terminal lobes and longitudinal pad are more strongly adpressed to one another.

Coxæ on the third and fourth pairs of legs of the male produced into club-like, egg-shaped processes strongly constricted at the base, and extending beyond the prefemur. Femur, postfemur, and tibia with longitudinal furrows on the inside. Coxæ on the fifth-seventh pairs of legs of the male broadly rounded on the end and somewhat produced, but without club-like processes.

The head on the end of the process of the anterior gonopodal sternite is separated off by a transverse suture and is almost semicircular, but above the semicircle it is produced in a triangular projection, almost to a point. On the broad telopodites ("T" in Brölemann's figure[20]) the *lamella*, which is bent back against the base, is not produced triangularly, but bent at an obtuse angle; moreover, the telopodite, except on the terminal fourth, forms a *longitudinal pad* on the border opposite to the coxite process. Longitudinal pad and lamella are both disposed with the free border against the coxite process, but lie on the opposite surfaces of the telopodite (in Brölemann's figures the longitudinal pad is quite lacking).

Occurrence.—Upper Richmond River, New South Wales, April.

List of Australian Diplopoda Described in this Paper.

1. *Cyliosoma excavatum* sp. nov.
2. *Cyliosoma penicilligerum* sp. nov., *Paracyliosoma* subg. nov.
3. *Cyliosoma queenslandicum* Bröl.
4. *Cyliosomella andersoni* sp. nov.
5. *Cyliosomella andersoni dorrigense* subsp. nov.
6. *Walesoma* n. g., *helmsii* sp. nov.
7. *Paraulacoporus* n. g., *sulcatus* sp. nov.
8. *Solänodolichopus walesius* sp. nov.
9. *Solänodolichopus rubriventris* sp. nov.
10. *Dicladosoma annulatipes* Verh.
11. *Dicladosoma andersoni* sp. nov.
12. *Dicladosoma andersoni dorrigense* subsp. nov.
13. *Hoplatessara* n. g., *musgravei* sp. nov.
14.. *Hoplatessara clavigera* sp. nov.

[20] Brölemann.—Rec. Austr. Mus., x, 6, 1913, pl. xv., fig. 28.

15. *Leucotessara* n. g., *lucida* sp. nov.
16. *Myallosoma* n. g., *hamuligerum* sp. nov.
17. *Rhopaloscales* n. g., *clavigera* sp. nov.
18. *Walesbolus* n. g., *lobatus* sp. nov.
19. *Howeobolus* n. g., *insularum* sp. nov.
20. *Attemsobolus dorsovittatus* sp. nov.
21. *Trigoniulus montium* sp. nov.
22. *Trigoniulus hebes*, sp. nov.
23. *Trigoniulus digitulus richmondanus* subsp. nov.

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ADDENDUM.

R. V. Chamberlin's "Myriopoda of the Australian Region"[21] came to my notice after this paper had been completed. It must, however, be emphasized that identification of any of the forms described here with those of Chamberlin is excluded, for his work is unaccompanied by illustrations, and without figures identification is impossible in the case of the majority of Diplopod species. As regards the Diplopoda at least, Chamberlin's paper is too provisional in character to permit of its being used for systematic purposes.

[21] Chamberlin.—Bull. Mus. Comp. Zool. Harvard, lxiv, 1, 1920, pp. 1-

ON THE GENUS *STRATIODRILUS* (*Archiannelida: Histriobdellidæ*), WITH A DESCRIPTION OF A NEW SPECIES FROM MADAGASCAR.

By

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(Figures 1-3.)

GENERAL.

THE genus *Stratiodrilus* was established by the late Professor W. A. Haswell, F.R.S.,[1] for the reception of a species of Histriobdellid found upon fresh-water crayfishes in Tasmania. Subsequently[2] Haswell described a second species from the common spiny crayfish of New South Wales, *Astacopsis serratus*. Amongst some papers which came into my hands after Professor Haswell's death was a letter from Dr. E. H. Cordero of Monte Video, which recorded the finding in 1921 at two different localities in Uruguay of a species of *Stratiodrilus* upon a fresh-water Anomurous Decapod, *Æglea lævis*. Dr. Cordero enclosed a camera outline of this species, which I have redrawn and reproduce here as Fig. 3. Quite recently my colleague Miss Lucy M. Wood, B.A., who is working upon the Temnocephaloidea, obtained through the kindly interest of M. Nettement, Consul-General for France in Australia, and of the Governor-General of Madagascar, a number of individuals of the Madagascar crayfish, *Astacoides madagascariensis*. On examining the precipitate at the bottom of the bottles in which these animals were contained, I found, as I had hoped and expected, a species of *Stratiodrilus* present in very considerable numbers. This is described below. It may be presumed that these animals came from the gill-chambers of the crayfish, although I was not able to find any in that situation, all having apparently dropped to the bottom after being killed by the formalin in which the hosts were preserved.

The range of *Stratiodrilus* is thus extended from Australia to South America on one hand and to Madagascar on the other, and this fact induces me to prophesy with some confidence that the genus will yet be found upon the crayfishes *Parastacus* in South America and *Paranephrops* in New Zealand. These discoveries strengthen the argument which I have used on two previous

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[1] Haswell.—On a New Histriobdellid, Quart. Journ. Micro. Sci., xliii, 1900, pp. 299-335.

[2] Haswell.—Notes on the Histriobdellidæ, *id.*, lix, 1913, pp. 197-226.

occasions[3] as to the southern crayfish and their parasites demanding former land connections between Australia, Madagascar and South America.

A further point of interest arises in regard to the distribution of the Histriobdellidæ as a whole. There are but two genera, *Histriobdella,* with a single species, found upon the European marine lobster, *Nephrops norvegicus,* and *Stratiodrilus,* found upon fresh-water Decapods, principally crayfish. The latter genus is much more highly organized and specialized than the former, though the two are obviously closely related. So long as *Stratiodrilus* was known only by two closely allied species from Australia, no conclusions could justifiably be drawn from this relationship. But the range of the genus has here been extended to become coincident with that of the Parastacid crayfishes of the southern hemisphere, and it is found associated with fresh-water Decapods in three widely separated southern land masses.

It seems reasonable to conclude that *Stratiodrilus* comes of marine ancestors, and that it, or an ancestral form of it, lived upon the marine forerunner of the Parastacid crayfishes. The transition to fresh-water conditions must have taken place once, and once only, upon a single land mass, for, even if it be argued that there were several migrations of marine Decapods carrying Histriobdellid parasites from the sea to the fresh waters of widely separated southern lands, these could not have received fresh-water Temnocephaloid parasites, which again must have had common origin on a single land mass. The association of the Parastacid crayfish with two unrelated parasitic groups, one probably of marine origin, the other giving no evidence of such an origin, seems to me to demand conclusively that there should have been land connections between Madagascar, Australia, New Zealand and South America in past time. Wegener gives the most plausible suggestion, and I have discussed this elsewhere.[4] A difficulty would arise in connection with the absence of crayfishes from Africa, and it must be supposed that Madagascar had no land connection with Africa after it had received its crayfishes from the east.

Finally, since a marine Histriobdellid occurs in European waters, why is there none of this group upon the Potomobiid crayfishes of the northern hemisphere? Possibly they are there, but have not been searched for and found. It is also possible, however, that the northern crayfishes were forced into a transition into fresh waters which was too rapid to allow so delicate a creature as a Histriobdellid to adjust itself to the change, while, perhaps, with the Parastacids the change was more gradual. Much of the fresh-

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[3] Harrison.—The Migration Route of the Australian Marsupial Fauna, Austr. Zoologist, iii, 8, 1924, p. 261. Crucial Evidence for Antarctic Radiation, American Naturalist, lx, 1926, pp. 374-383.

[4] Harrison.—The Composition and Origins of the Australian Fauna, with Special Reference to the Wegener Hypothesis. Presidential Address to Section D, Austr. Assoc. Adv. Science, Perth, 1926 (in the press).

water fauna of eastern Europe is a relict marine fauna, and the Potamobiids may have originated in the same way. It does not seem probable, moreover, that this group is in any way ancestral to the Parastacids. It is more likely that they have been derived from similar, or even the same, marine ancestors, under different conditions and in different places.

SYSTEMATIC.

Genus STRATIODRILUS *Haswell.*

Stratiodrilus Haswell, Quart. Journ. Micr. Science, xliii, 1900, p. 300.

Histriobdellids with head, five body-segments, and an imperfectly segmented tail region. The head bears a median and two pairs of lateral tentacles, and a pair of retractile anterior limbs. The body bears three pairs of lateral cirri, and, in the male, a pair of retractile claspers. The posterior limbs carry a pair of posterior cirri. Cirri and tentacles usually two-jointed.

Genotype:—*S. tasmaniensis* Haswell.

Key to Species of *Stratiodrilus*:

A. Lateral cirri bifurcated at tips; masticating apparatus large, 0·17 to 0·185 mm. in length .... *S. haswelli. n. sp.*

AA. Lateral cirri not bifurcated.

  B. Lateral cirri not two-jointed; masticatory apparatus small, 0·10 to 0·11 mm. in length .... *S. sp.* (Uruguay)

  BB. Lateral cirri two jointed.

    C. Posterior limb cirrus two-jointed; masticatory apparatus medium, 0·14 mm. long .... *S. novæ-hollandiæ*

    CC. Posterior limb cirrus simple; masticatory apparatus 0·12 mm. long .... *S. tasmanicus*

STRATIODRILUS TASMANICUS Haswell.

Stratiodrilus tasmanicus Haswell, Quart. Journ. Micro. Sci., xliii, 1900, p. 300, Pl. xiv, fig. 1; *id.*, Parker and Haswell, Text-book of Zoology, 2nd Edit., Vol. i, p. 338, fig. 275, 3rd Edit., Vol. i, p. 331, fig. 280; London, Macmillan, 1910 and 1921.

Length 1 mm. to 1·5 mm. Masticating apparatus 0·12 to 0·13 mm. This species is fully described and figured by Haswell (*loc. cit. sup.*). It is very closely allied to that which follows, the principal differences being that in *S. tasmanicus* the masticatory apparatus is proportionately shorter, and that the cirri of the posterior appendages are simple, and not two-jointed.

Hosts:—*Astacopsis franklinii* Gray, and *A. franklinii,* var. *tasmanicus,* Erichson, Tasmania.

Stratiodrilus novæ-hollandiæ *Haswell.*

(Figure 1.)

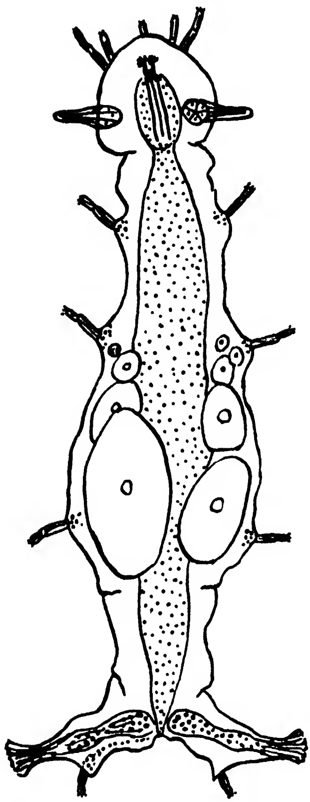


Fig. 1.—*Stratiodrilus novæ-hollandiæ* Haswell, ♀.

Stratiodrilus novæ-hollandiæ Haswell, Quart. Journ. Micro. Sci., lix, 1913, p. 199.

Length 1 mm. to 1·5 mm. Masticating apparatus 0·14 mm. As this species has not been figured, I give a figure of the female. The male differs only in the possession of a pair of retractile claspers on the fourth body segment, and in the organs of reproduction. It is probable that Haswell's description of the nephridia is far from complete. He based his observations to a large extent upon ciliary movement in the lumina in the living animal. From the appearances in a single mounted individual (out of a very considerable number) which has for an unknown reason taken up stain in the lumina of the tubules, these are seen to ramify extensively, and to end in many fine branches in certain positions. It is hoped to re-examine this matter at a later date.

Host:—*Astacopsis serratus* Shaw, New South Wales.

Stratiodrilus haswelli, *sp. nov.*

(Figure 2.)

Length 0·7 to 0·9 mm. Masticatory apparatus 0·17 to 0·19 mm. The three pairs of lateral cirri bifurcated at the tips, with a minute sensory papilla in the angle. There is, in addition to the usual two-jointed cirrus of the posterior limbs, a small undivided cirrus on the postero-lateral margin. The penis of the male differs from that of the two previous species by being more solid at the base, and by having but a single projecting process (Fig. 2*c, d*) in place of three. The masticatory apparatus is built on precisely the same pattern, but is remarkably more robust for so small a species. The general arrangement of the internal organs is the same, with

the exception that the ganglia of the nerve cord are not so massive, and tend to be divided into two lateral masses of nerve cells rather than a single solid aggregate. Figure 2*a* represents the female, and 2*b* the male.

Host:—*Astacoides madagascariensis* Milne Edwards, Madagascar.

Types:—Holotype ♂ and allotype ♀ in the Australian Museum, Sydney, registered numbers W2464 and W2465 respectively.

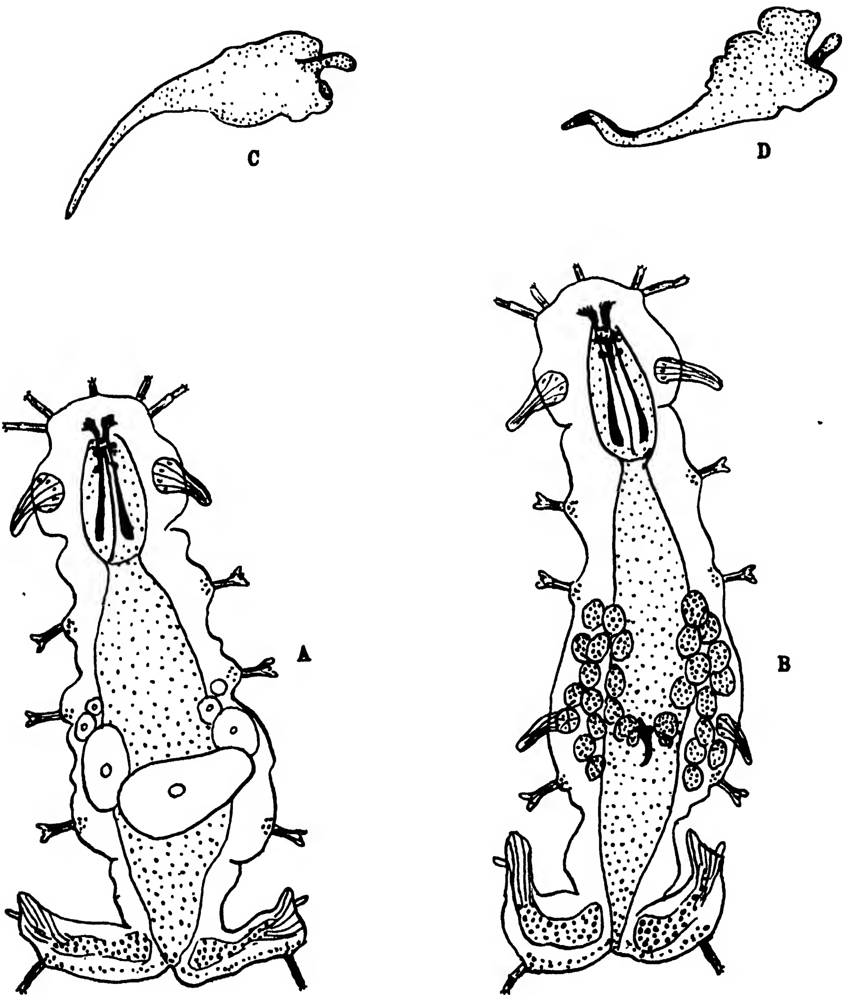


Fig. 2.—*Stratiodrilus haswelli* Harrison: A, ♀; B, ♂; C and D, aspects of the penis.

The species is named in honour of the late Professor Haswell, founder of the genus, who took a keen interest in these curious small animals.

STRATIODRILUS *sp.*

(Figure 3.)

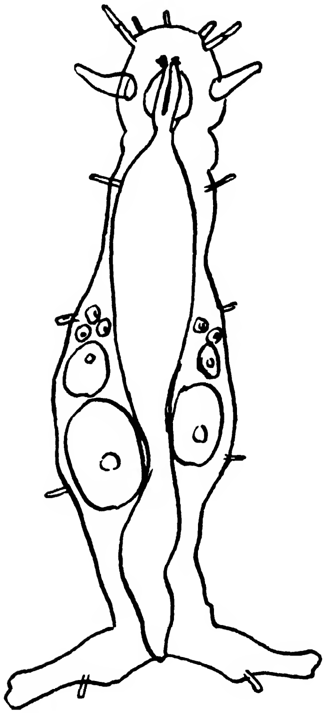


Fig. 3.—*Stratiodrilus* sp. from Uruguay.

This is the species mentioned above as having been discovered by Dr. E. H. Cordero in Uruguay. A camera outline of a female, 1·4 mm. in length, accompanied Dr. Cordero's letter. Calculated in proportion to this length, the masticatory apparatus would measure 0·107 mm. I have reproduced the sketch to show conclusively that the animal is undoubtedly a species of *Stratiodrilus*. It differs from *S. novæ-hollandiæ,* so far as one may judge from a mere pencil outline, which was not meant to be diagnostic, in having the three median tentacles of the head and the lateral and posterior cirri simple, not two-jointed.

Host:—*Æglea lævis* Latr. (Brachyura Anomura), Uruguay.

I have included a reference to this species without consulting Dr. Cordero, of whose whereabouts I am ignorant, since zoogeographically it is important.

EXPLANATION OF PLATE VI.

Figs. 1-4. *Cyliosoma excavatum* sp. nov.

Fig. 1. Femur and tibiotarsus of the telopods seen from the front; × 56.

Fig. 2. Certain parts of the stridulating band on the tibiotarsus of the telopods; × 220.

Fig. 3. Terminal parts on the syncoxite of the telopods; *lo,* lobe; *pr,* horn; × 56.

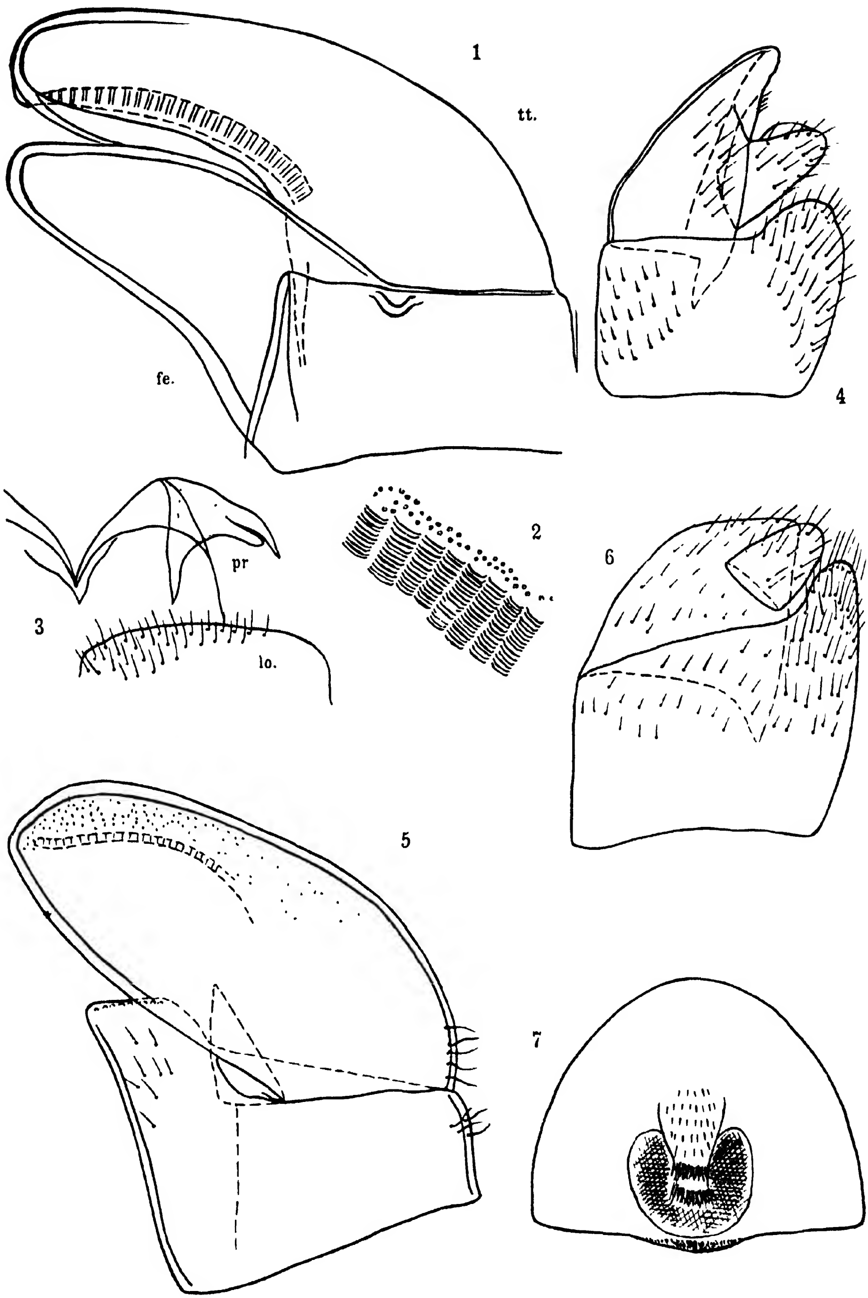
Fig. 4. The three terminal segments of the co-telopods; × 56.

Figs. 5-7. *Cyliosoma penicilligerum* sp. nov.

Fig. 5. Femur and tibiotarsus, front view; × 56.

Fig. 6. Three terminal segments of the co-telopods; × 56.

Fig. 7. Bitelotergite of the male represented from directly behind; × 8.


1
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pr
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EXPLANATION OF PLATE VII.

Figs. 8-10. *Cyliosomella andersoni* sp. nov.

Fig. 8. Femur (*fe*) and tibiotarsus of the co-telopods; *pr*, process of the former; *y*, accessory lobe of the same; × 56.

Fig. 9. Syncoxite and left telopodite of the telopods viewed from the front; × 10.

Fig. 10. Tibiotarsus and femoral process of the telopods, front view; × 56.

Fig. 11. *Paraulacoporus sulcatus* gen. et sp. nov.

Fig. 11. Gonopod without prefemoral segment and without coxa; × 56.

Figs. 12, 13. *Myallosoma hamuligerum* gen. et sp. nov.

Fig. 12. Gonopod-telopodite; *prf*, prefemur; *fe*, femur; pr^1 and pr_2, lateral rami of the same; *tt*, tibiotarsus; sl_1 and sl_2, rami of the solænomerite; *b*, point of separation of tibiotarsus and solænomerite; *r*, spermatic channel; × 56.

Fig. 13. Tibiotarsus and solænomerite of the foregoing; × 125.

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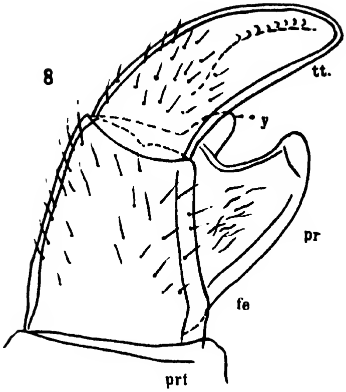

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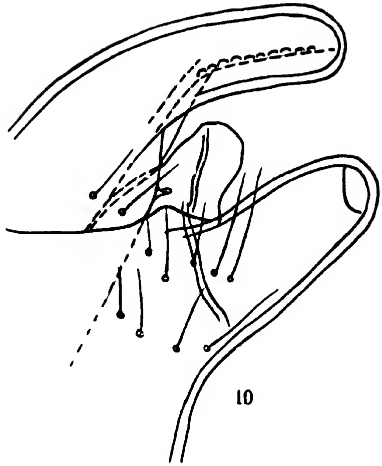

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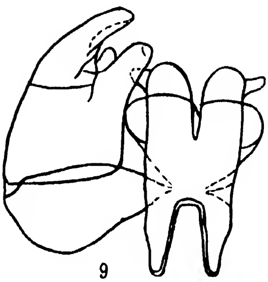

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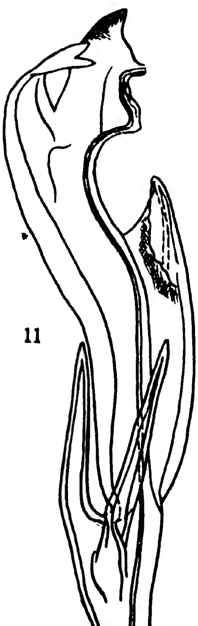

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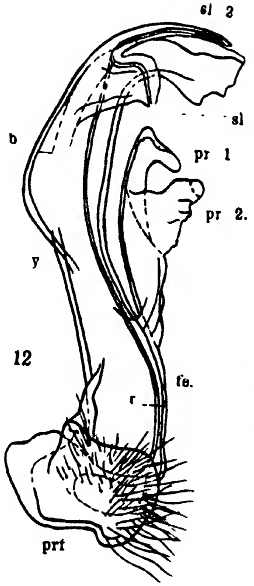

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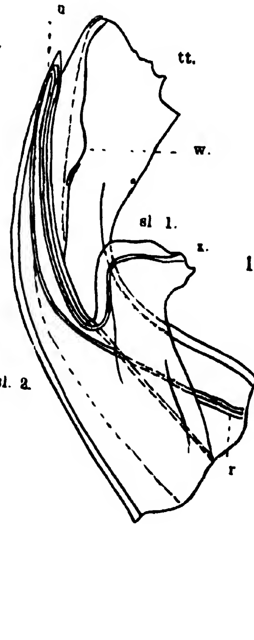


EXPLANATION OF PLATE VIII.

Figs. 14, 15. *Rhopalocrales clavigera* gen. et sp. nov.

Fig. 14. Gonopod-telopodite without coxa, lettering as in Pl. vii, fig. 12; × 56.

Fig. 15. Solænomerite; *u*, large loop of the spermatic canal; *x*, opening of the same; × 125.

Figs. 16, 17. *Welestina helmsii* gen. et sp. nov.

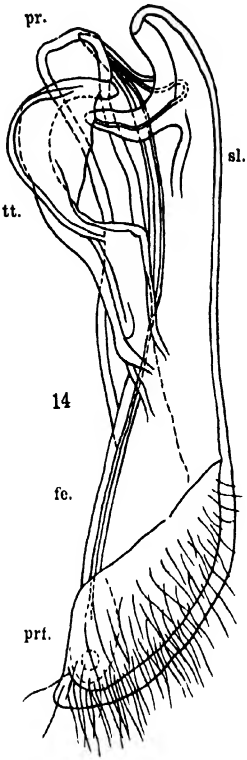
Fig. 16. Gonopod-telopodite and terminal half of the coxæ, with the coxal horn (*coa*); *y*, boundary between femur and tibiotarsus; × 56.

Fig. 17. Terminal lobe of the solænomerite with the opening of the spermatic canal (*x*); × 220.

Figs. 18, 19. *Dicladosoma andersoni* gen. et sp. nov.

Fig. 18. Tibiotarsus and solænomerite (*sl*), without bases; × 56.

Fig. 19. Basal half of the gonopod-telopodite with the bases of the foregoing; × 56.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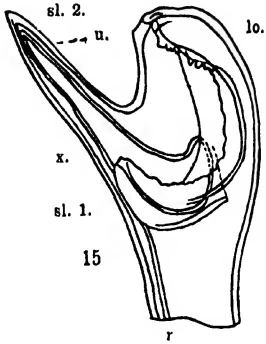
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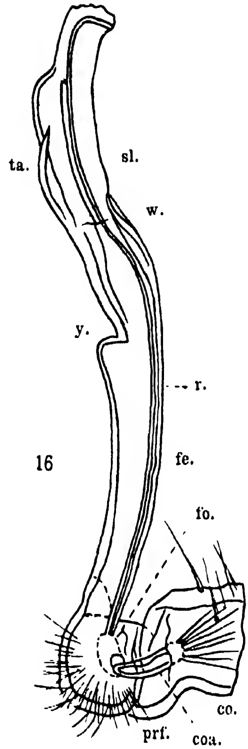
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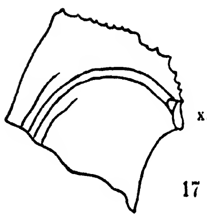
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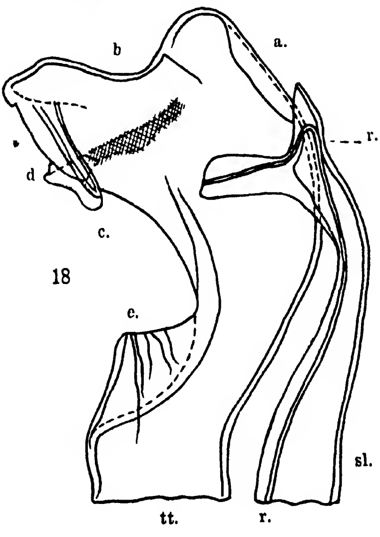
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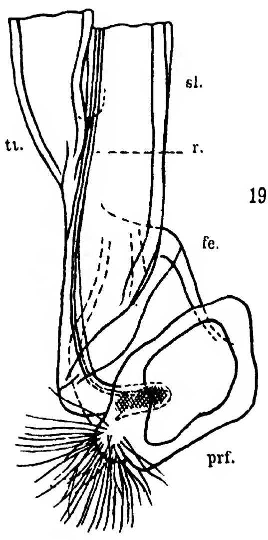
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EXPLANATION OF PLATE IX.

Fig. 20. *Leucotessara lucida* gen. et sp. nov.

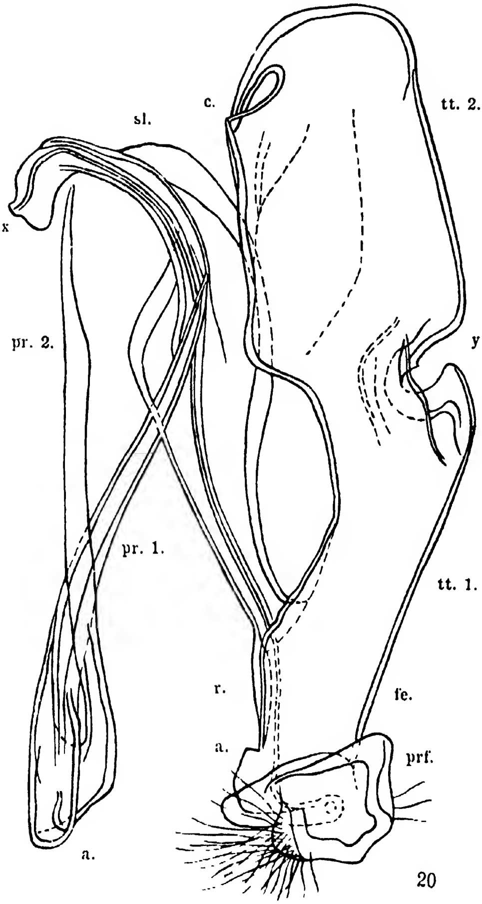
Fig. 20. Gonopod-telopodite in which the femoral lateral rami are broken off at *a* and shown separately on the left (pr_1 and pr_2); tt_1 tibial, tt_2 tarsal segments of the tibiotarsus; × 56.

Figs. 21, 22. *Hoplatessara musgravei*, gen. et sp. nov.

Fig. 21. Complete gonopod-telopodite (lettering as in Pl. vii, fig. 12); × 56.

Fig. 22. Terminal segment of the solænomerite; *x*, opening of the spermatic canal; × 125.

Fig. 23. *Dicladosoma andersoni dorrigense*, subsp. nov.
Tibiotarsus of the gonopods without basal portion; × 56.



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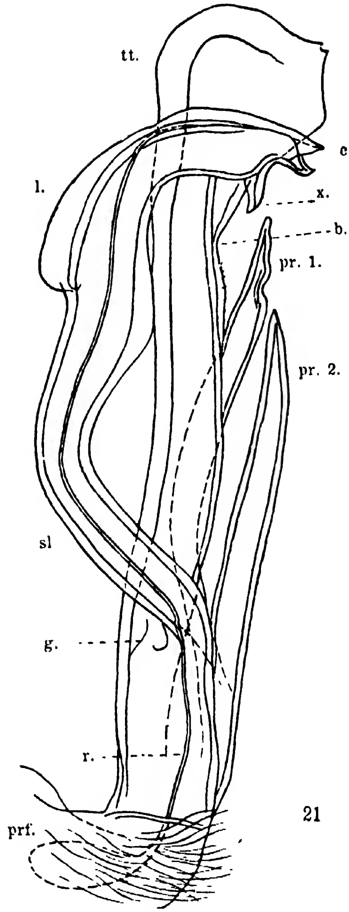

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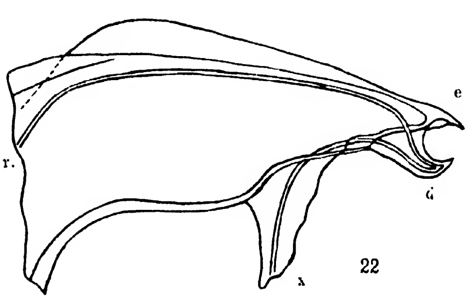

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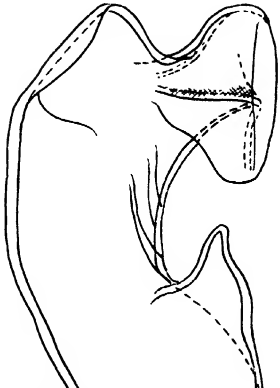


23

EXPLANATION OF PLATE X.

Figs. 24, 25. *Solänodolichopus rubriventris* sp. nov.

Fig. 24. Tibiotarsus and femoral lateral ramus (*pr*) of the gonopods; × 56.

Fig. 25. Terminal lobe of the solænomerite with the opening of the spermatic canal; × 125.

Figs. 26, 27. *Solänodolichopus walesius* sp. nov.

Fig. 26. Tibiotarsus and terminal portion of the femur of the gonopods; × 56.

Fig. 27. Terminal lobe of the solænomerite with the opening (*x*) of the spermatic canal; × 125.

Fig. 30. *Hoplatessara clavigera* sp. nov.

Fig. 30. Terminal third of the longer lateral ramus of the gonopodal femur; × 125.

Figs. 31, 32. *Walesbolus lobatus* gen. et sp. nov.

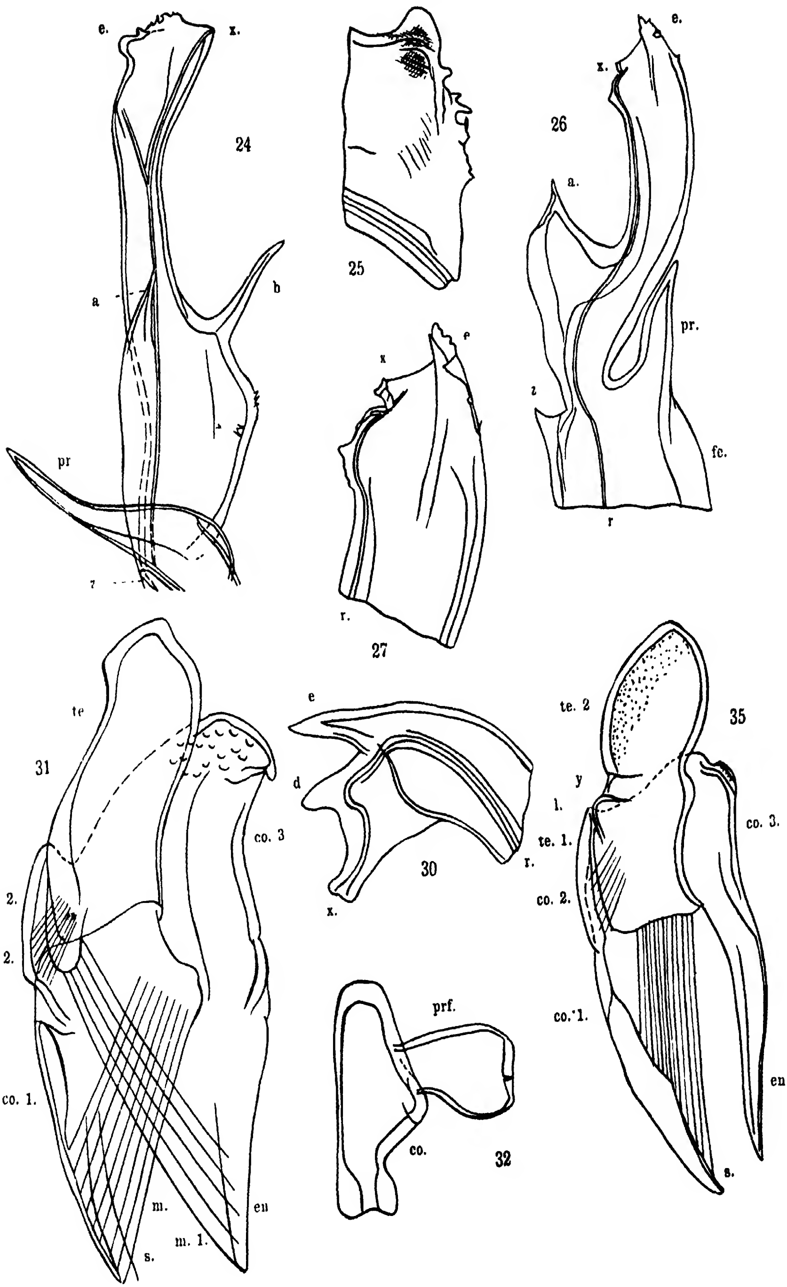
Fig. 31. An anterior gonopod, isolated and bent somewhat apart; *s*, muscle support; *cn*, coxal muscle process; *co* 1-3, parts of the coxite; *te*, telopodite; *m*, m_1, m_2, motors of the same; × 56.

Fig. 32. Coxa and prefemur of a third pair of legs of the male; × 80.

Fig. 35. *Howeobolus insularum* gen. et sp. nov.

Fig. 35. An anterior gonopod (as in fig 31); *y*, constriction between the two segments of the telopodite (te_1 and te_2); × 56.

PLATE X.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EXPLANATION OF PLATE XI.

Figs. 28, 29. *Hoplatessara clavigera* sp. nov.

Fig. 28. Gonopod-telopodite, without prefemur; *a*, point of attachment of the femoral lateral rami (pr_1 and pr_2); *g*, base of attachment of the solænomerite (*sl*); × 56.

Fig. 29. Terminal third of the longer lateral ramus of the gonopodal femur; × 125.

Figs. 33, 34. *Walesbolus lobatus* gen. et sp. nov.

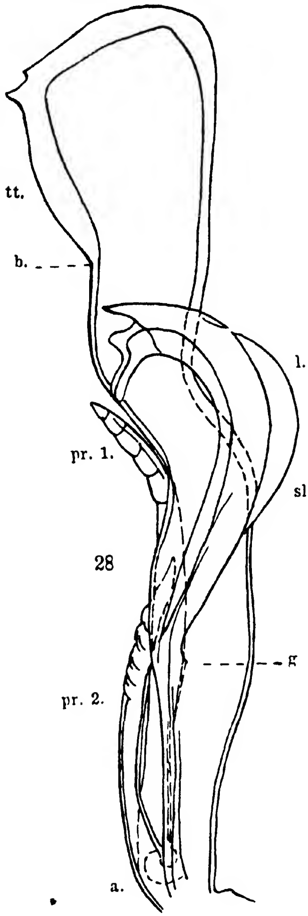
Fig. 33. Terminal segment of the main portion of the gonopodal coxa; × 125.

Fig. 34. Posterior gonopod, united flexibly with the muscle support (*s*), of which the end is shown; × 56.

Figs. 36, 37. *Howeobolus insularum* gen. et sp. nov.

Fig. 36. A posterior gonopod, without muscle support; × 56.

Fig. 37. Coxa and prefemur of a third pair of legs of the male; × 80.



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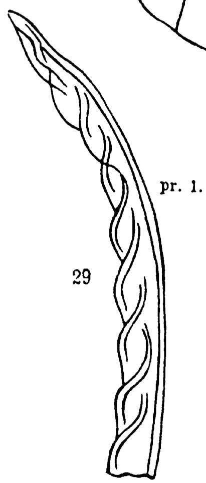

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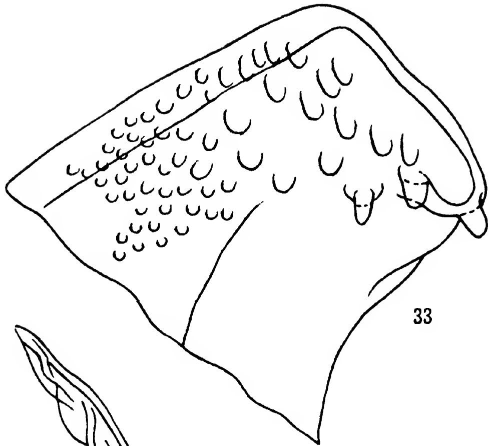

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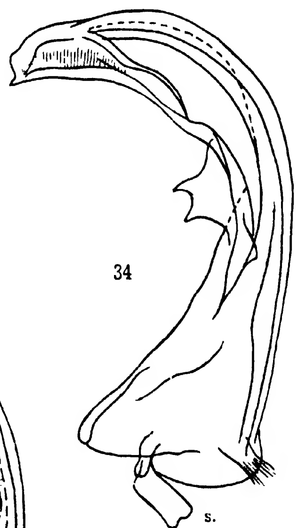

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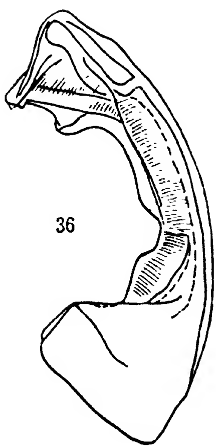

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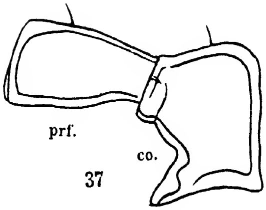

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EXPLANATION OF PLATE XII.

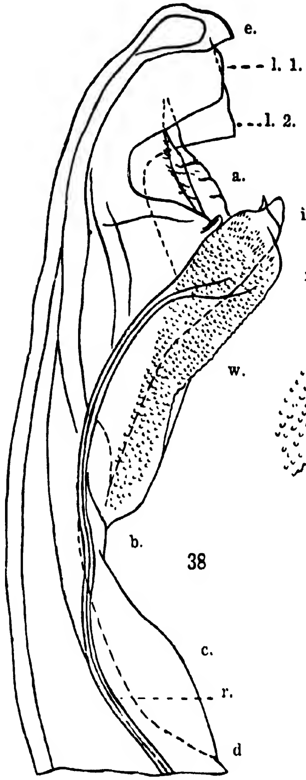
Figs. 38, 39. *Trigoniulus montium*, sp. nov.

Fig. 38. Telopodite of the posterior gonopods without the basal portion; *w*, inner pad, with the opening (*x*) of the spermatic canal (*r*); near it (*w*) a part of the pad more strongly magnified (× 125); *b*, inner constriction; *e*, terminal point; × 56.

Fig. 39. The four proximal joints of a third pair of legs of the male; × 56.

Fig. 40. *Trigoniulus digitulus richmondanus* subsp. nov.

Fig. 40. Telephodite of the posterior gonopods without the basal portion; *w*, inner pad with the opening (*x*) of the spermatic canal and a pit-like hollow (*fo*); *b*, constriction; *k*, pore cushion; *e*, terminal lobe; × 56.



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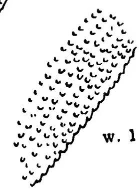

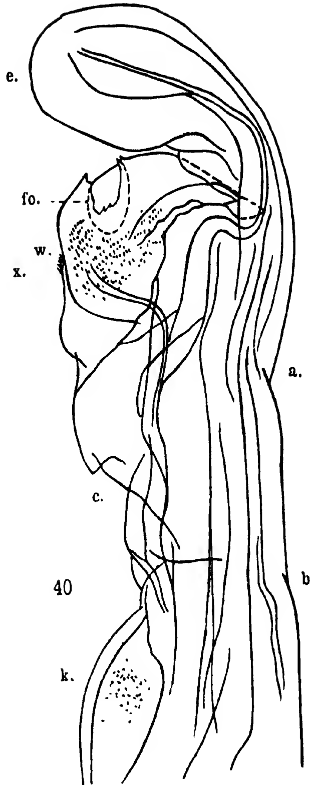

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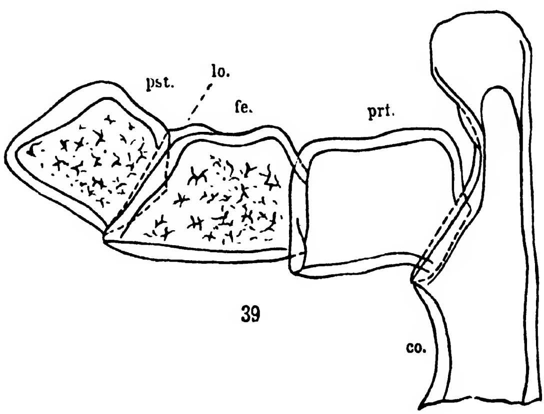

39

HERPETOLOGY OF THE SOLOMON ISLANDS.

By

J. R. Kinghorn, C.M.Z.S.

(Plates xiii-xv and Figures 1-35.)

The following paper is based on the collection of Solomon Islands reptiles and amphibians in the Australian Museum. The greater portion of this material has been added during the last three years by the efforts of Mr. N. S. Heffernan, District Officer at Ysabel Island, and Mr. C. E. Hart, of Gaudalcanar.

In the past many papers have been written concerning the herpetology of the Solomons, but as they are scattered in many publications, students are precluded from consulting them, unless they have the facilities of a reasonably complete library at their disposal. It was this which prompted me, while working through the collection, to assemble and modify previous descriptions, to republish old and add new figures, and to compile keys to the species, so that future workers will have a complete reference to the reptiles and amphibians of this group of islands.

BATRACHIA.

Key to the families (Fig. 1).

A. Shoulder girdle firmly united, chest not expansible, diapophyses of sacral vertebræ cylindrical or only slightly dilated.

B. Upper jaw toothed, skin smooth or warty .... Ranidæ

BB. Both jaws toothed, snout, eyelids and other parts bearing thorn-like prominences .... Ceratobatrachidæ

AA. Shoulder girdle not firmly united, overlapping, chest expansible, diapophyses of sacral vertebræ dilated .... Hylidæ

Family RANIDÆ.

Key to the genera.

A. Vomerine teeth present.

B. Toes strongly webbed, fingers free, outer metatarsals connected by a web .... *Rana*

BB. Toes free or with only rudiment of web, fingers free, outer metatarsals united or separated by a groove.

C. Fingers and toes with large discs .... *Cornufer*

CC. Fingers and toes cylindrical, no discs ... *Platymantis*

AA. No vomerine teeth, fingers and toes with large discs.

D. Fingers and toes webbed .... *Hypsirana*

DD. Fingers and toes without webs .... *Batrachylodes*

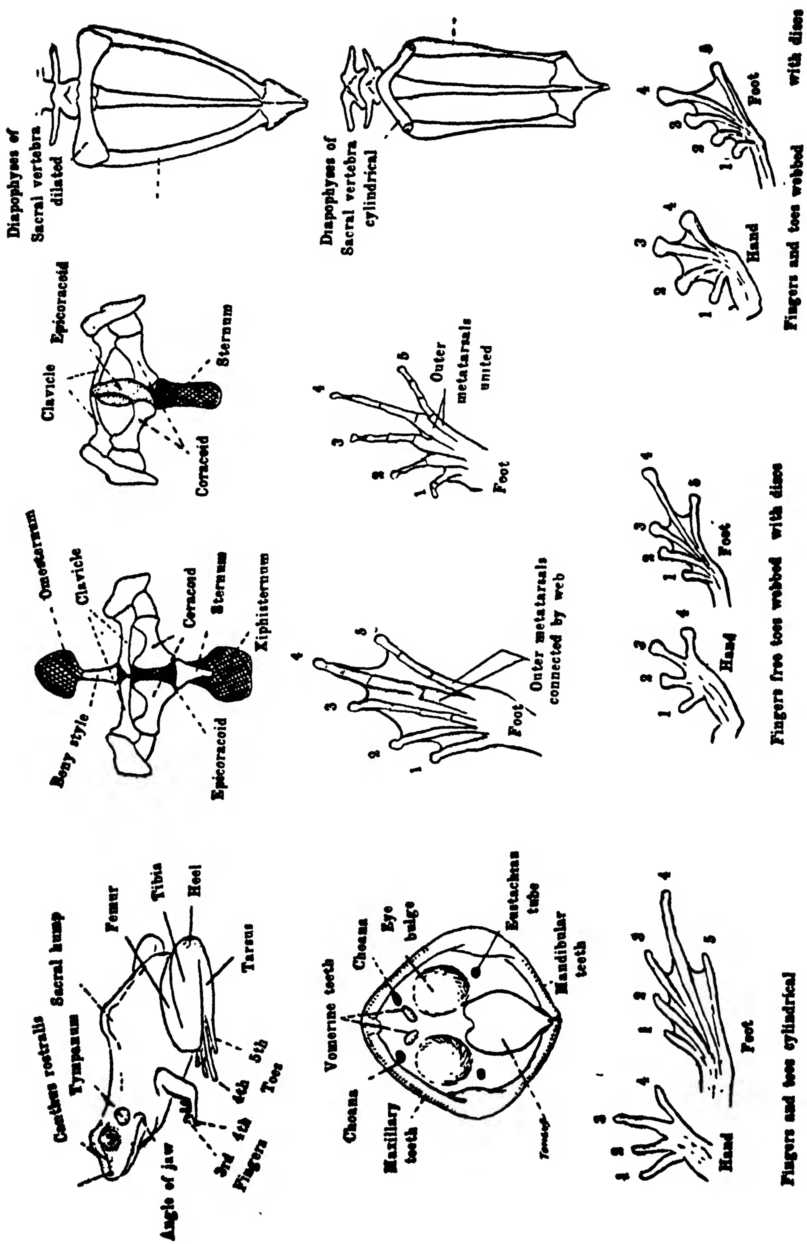

Fig. 1.—Guide to the Key to the Frogs.

Genus RANA *Linnæus.*

Rana Boulenger, Brit. Mus. Cat. Batr. Ecaud., 1882, p. 6.

Boulenger[1] divides this genus into nine subgenera, of which two refer to species occurring in the Solomon Islands, viz.:

1. *Discodeles* for two species, *Rana bufoniformis* and *R. guppyi*, which may be distinguished as follows: Tips of toes and fingers dilated into discs, the upper surfaces of which are separated from the lower by a crescentic or horseshoe-shaped groove; web not penetrating far between the outer metatarsals. Vomerine teeth in transverse or oblique series behind the choanæ, or on a level with the posterior border of the latter. Tongue with a large retractile papilla in the middle. Glandular dorso-lateral fold, if present, not confluent with the temporal. Nasal bones large, in contact with each other and with the fronto-parietals. Omosternal style forked at the base.

2. *Hylorana* (*Rana krefftii*) differs from the above in having the vomerine teeth between the choanæ; the canthus rostralis is strong and angular; the glandular dorso-lateral fold is confluent with the temporal; the nasal bones are narrow and oblique, and widely separated from each other and from the fronto-parietals. The omosternum is not forked at the base.

For convenience I have compiled a key by which the species may be easily separated, as follows:

A. Canthus rostralis vertical, strong, snout sharp pointed. Vomerine teeth between the choanæ .... *krefftii*

AA. Canthus rostralis oblique, obtuse, snout broadly rounded, vomerine teeth behind the choanæ.

B. Vomerine teeth not extending outwards beyond the vertical of the inner edges of the choanæ .... *bufoniformis*

BB. Vomerine teeth extending outwards beyond the vertical of the inner edges of the choanæ .... *guppyi*

RANA KREFFTII *Boulenger.*

(Fig. 2.)

Rana krefftii Blgr., Brit. Mus. Cat. Batr. Ecaud., 1882, p. 64, Pl. iii, fig. 2. *Id.* Barbour, Proc. New Eng. Zool. Club, vii. 1921, p. 97.

Main Characters.—Vomerine teeth in two oblique groups between the choanæ. Head depressed, snout narrow, sharp pointed, canthus rostralis strongly defined. Tympanum very distinct, two-thirds the size of the eye; interorbital space as broad as the upper eyelid. Fingers and toes rather slender, toes almost entirely webbed; when the hind limb is stretched forward, the tibiotarsal articulation extends slightly beyond the eye. Skin smooth.

[1] Boulenger.—Records Indian Museum, xx, 1920, p. 5.

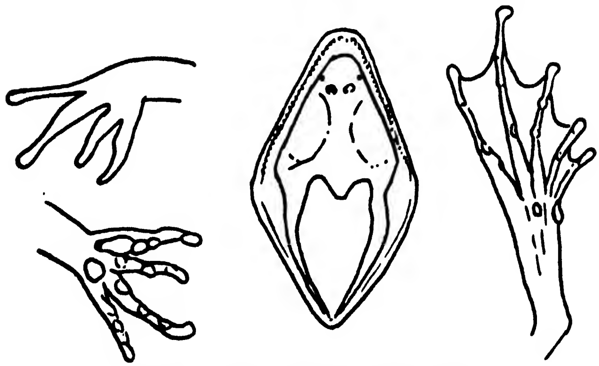

Fig. 2.—*Rana krefftii* Boulenger.

Colour (in spirits).—Brownish above, darker on the sides of head and body, forming a distinct lateral band. A dark band from eye to snout, bordered by a white upper lip and a thin white line along the canthus rostralis. Under surfaces white, more or less mottled with brown. The thighs are mottled on the upper as well as the lower surfaces.

Measurements of adult from snout to vent average 60 to 70 mm.

Mr. Heffernan sent two typical specimens 60 mm. in length from the Government Station, Tunabuli Harbour, and two young 35 and 38 mm. In the young the markings are very distinct and the white lip is a prominent feature.

Distribution.—This species is common on most of the islands throughout the Solomon group.

Rana bufoniformis *Boulenger.*

(Fig. 3.)

Rana opisthodon Blgr., Proc. Zool. Soc. London, 1884, p. 211. *Id.* Trans. Zool. Soc., xii, 1886, p. 50, Pl. x.

Rana bufoniformis Blgr., Proc. Zool. Soc. London, 1884, p. 210. *Id.* Trans. Zool. Soc., xii, 1886, p. 47, Pl. viii.

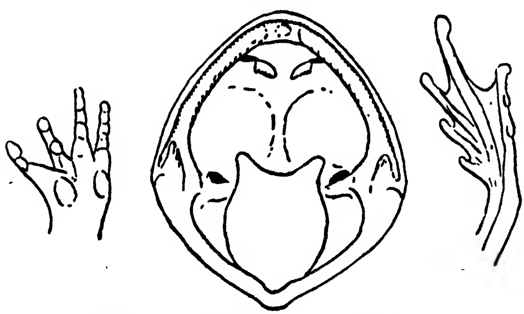

Fig. 3.—*Rana bufoniformis* Boulenger.

Rana bufoniformis Barbour, Proc. New Eng. Zool. Club, vii, 1921, pp. 98-99.

Main Characters.—Canthus rostralis obtuse, snout broadly rounded, vomerine teeth behind the level of the choanæ and not extending outwards beyond the vertical of the inner edges of the choanæ.

Habit very stout, nostril nearer the tip of the snout than the eye. Fingers short, thick, with slightly swollen tips, the first as long as or a little longer than the second, the third about as long as the snout. Hind limb short; when stretched forward the tibiotarsal articulation reaches the temple. Toes short, two-thirds to three-quarters webbed, the tips dilated into small discs, of which the upper half is divided from the lower by a groove.

Upper parts more or less warty; lower parts smooth, except for the belly and thighs, which are slightly granulate.

Colour.—Brownish above, with or without some dark spots or cross bars on the limbs. Lower parts brownish white.

Specimens in the Australian Museum from Uji, Solomon Islands.

RANA GUPPYI *Boulenger.*

(Fig. 4.)

Rana guppyi Blgr., Proc. Zool. Soc. Lond., 1884, p. 211, and Trans. Zool. Soc. Lond., xii, 1886, p. 48, Pl. ix. *Id.* Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 98.

Fig. 4.—*Rana guppyi* Boulenger.

Main Characters.—Canthus rostralis oblique, obtuse, snout broadly rounded, vomerine teeth behind, and extending outwards beyond the vertical of the inner edges of the choanæ. Nostril much nearer the tip of the snout than the eye. Fingers long, the tips dilated into small discs. The first finger longer than the second, the third about as long as the snout. Hind limb fairly long; when stretched forward the tibiotarsal articulation reaches to the eye or the end of the snout. Toes three quarter or entirely webbed, the

tips dilated into small discs, which are somewhat larger than those of the fingers. Upper parts smooth or warty, lower parts smooth.

Colour.—Brownish above and white or brownish below; the lips and limbs may bear indistinct, darker bars.

Three specimens from Tunabuli Harbour and one from Kia, Ysabel Island. The latter when caught was in the act of eating a centipede, one half being in the mouth and the other in the gullet.

Genus CORNUFER *Tschudi.*

Cornufer Boulenger, Brit. Mus. Cat. Batr. Ecaudata, 1882, p. 107.

Main Characters.—Vomerine teeth present. Pupil horizontal. tympanum distinct. Fingers free, toes free or with only a rudiment of a web; fingers and toes with large discs. Outer metatarsals united or separated by a groove. Omosternum and sternum with a bony style. Terminal phalanges T-shaped.

CORNUFER GUPPYI *Boulenger.*

(Fig. 5.)

Cornufer guppyi Boulenger, Proc. Zool. Soc. London, 1884, p. 211. *Id.* Trans. Zool. Soc., xii, 1886, p. 53, Pl. xi, fig. 1. *Id.* Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 97.

Fig. 5.—*Cornufer guppyi* Boulenger.

Main Characters.—Vomerine teeth in two short, straight, or slightly oblique series behind the choanæ. Head large, broad, depressed, somewhat broader than the body. Snout rounded, canthus rostralis distinct, oblique, the loreal region concave. Fingers short and depressed, the tips dilated into large round discs, but there are no webs. The toes are about one-third webbed, and bear a narrow dermal margin; the discs are large, but smaller than those of the fingers. When the hind leg is stretched forward the tibiotarsal articulation reaches the eye. There is a prominent fold from the eye to the shoulder. The under parts, and the lower abdomen and thighs are granular, otherwise the integument is smooth.

Colour.—The general colour is greyish or pinkish brown above, with minute dark speckles or larger markings, the thighs usually barred with brown.

Distribution.—One specimen in the Australian Museum was collected by Captain Wolsch at Gaudalcanar in August, 1884. Others were collected by Mr. Heffernan in the following localities: one small specimen, 31 mm. in length, identical with a specimen of equal size from Nadaravati, Fiji Islands; two from Ysabel Island, 50 and 86 mm. in length.

Genus PLATYMANTIS *Günther.*

PLATYMANTIS SOLOMONIS *Boulenger.*

(Fig. 6.)

Cornufer solomonis Boulenger, Proc. Zool. Soc. London, 1884, p. 212. *Id.* Trans. Zool. Soc., xii, 1886, p. 54, Pl. xi, fig. 2.

Platymantis solomonis Boulenger, Ann. Mag. Nat. Hist., (9), i, 1918, p. 373. *Id.* Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 96.

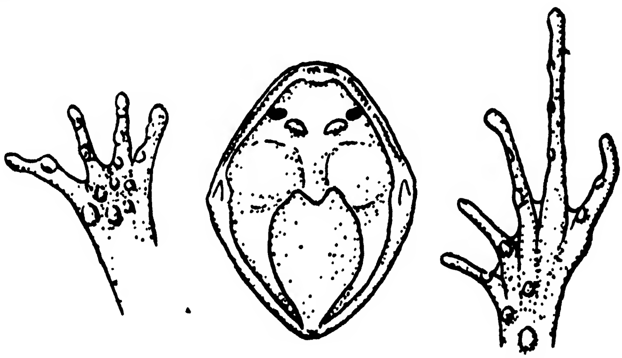

Fig. 6.—*Platymantis solomonis* Boulenger.

Main Characters.—Vomerine teeth in two long transverse or oblique series behind the level of the choanæ. Head large, as broad as the body, snout rounded, its length equal to the orbital diameter.

Canthus rostralis distinct, obtuse, the loreal region oblique, concave. Eye large, a slight median keel in the interorbital space.

Fore limb stretched backwards reaches as far as the vent; when the hind limb is carried forward, the tibiotarsal articulation reaches the eye.

Fingers slender, cylindrical, the tips not dilated but simply swollen, the subarticular tubercles remarkably strong and prominent; the inner finger as long as the third and fourth, and longer than the second. The three oval metatarsal tubercles are very distinct. Toes long, slender, free, there being only a slight rudiment of web at the base, tips swollen like those of the fingers.

Skin of the back granular, with irregular, scattered, longitudinal folds. A prominent oblique fold runs from eye to shoulder. Lower parts smooth except the lower belly and thighs.

Colour.—Grey, brown or purplish above with more or less distinct darker markings. Tympanum chestnut brown, loreal and temporal regions dark brown, lips and limbs with dark bars. Lower surfaces whitish.

Variation.—Of the specimens collected by Mr. Heffernan, nine are from Kia, Ysabel Island; all have rough backs, some are marbled above, while others have distinct light brown lateral stripes. One has typical markings on the sides, arms, and legs, but the back is uniform blackish.

Two specimens from Hivo, north-east Ysabel Island, one typical, the other with three light stripes, one dorsal and two lateral. Twenty specimens are from Tunabuli Harbour, three striped and three marbled, the largest being 82 mm. from snout to vent. As Dr. T. Barbour states, the older specimens have the smoother backs. The series before me proves that the wrinkles so characteristic of young specimens gradually disappear with age, and are entirely absent in the large old specimens. The specimens examined range from 30 to 85 mm. from snout to vent; the largest, which is from the Government Station, Tunabuli Harbour, contained the remains of hard-shelled insects and one crab. The collection also contains one from New Georgia, and one from Kinigunum, Bismarck Archipelago.

HYPSIRANA *gen. nov.*

Description.—Pupil round. No vomerine teeth. Fingers and toes webbed, the tips dilated into discs. Tongue free, heart shaped, deeply notched behind. Tympanum very indistinct, smaller than, or equal in size to the pupil. Outer metatarsals separated by a groove. Terminal phalanges T-shaped. Omosternum and sternum with a bony style.

HYPSIRANA HEFFERNANI *sp. nov.*

(Pl. xiii, figs. 7, 7A and Fig. 7.)

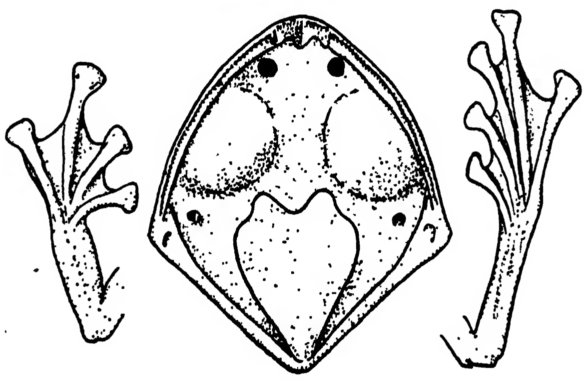

Fig. 7.—*Hypsirana heffernani*, gen. et sp. nov.

Description.—Vomerine teeth absent. Choanæ larger than the eustacean tubes. Head very large, flat, depressed, broader than long, broader than the body. Snout broadly rounded. Canthus rostralis indistinct; nostrils close together near the tip of the snout. Eye very large, interorbital space broader than the upper eyelid, as great as the distance from the eye to the nostril. Limbs slender, the tips of the fingers reaching to the vent, and when the hind limb is stretched forward the tibiotarsal articulation reaches the tip of the snout. Fingers somewhat flattened, fringed and about two-thirds webbed, the tips dilated into large discs. Toes almost fully webbed, the tips with large discs. Under surface of the feet and hands without tubercles. Skin smooth above, but granular on the sides, belly, and under surface of the upper arm and thighs.

Colour (in spirits).—At first purplish brown above and yellow below, but becoming yellowish all over with age.

Described from two specimens from Tunabuli Harbour, Ysabel Island, and named after the collector, Mr. N. S. Heffernan. Holotype in the Australian Museum, Reg. No. R.8619, paratype R.8618.

Genus BATRACHYLODES *Boulenger.*

Batrachylodes Boulenger, Proc. Zoöl. Soc. London, 1887, p. 337, Pl. xxviii, fig. 3.

Pupil horizontal. Vomerine teeth absent. Tongue oval, free and very feebly nicked behind. Tympanum distinct. Fingers and toes free, no rudiments of webs, the tips dilated into large discs. Distal phalanges T-shaped. Omosternum and sternum with a bony style.

BATRACHYLODES VERTEBRALIS *Boulenger.*

(Pl. xiii, fig. 6.)

Batrachylodes vertebralis Blgr., Proc. Zool. Soc. London, 1887, p. 337, Pl. xxviii, fig. 3. *Id.* Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 95.

Main Characters.—No vomerine teeth, snout short, obtusely pointed, canthus rostralis distinct, loreal region almost vertical, head small, narrower than the body. Nostril nearer the tip of the snout than the eye, interorbital space broader than the upper eyelid. Tympanum three-fifths the diameter of the eye.

When the hind limb is stretched forward the tibiotarsal articulation reaches the eye. Fingers and toes slender, the tips dilated into large discs, those of the toes being the smaller; disc of third finger equal in size to the tympanum; first finger shorter than the second. Skin smooth above and below.

Colour.—Usually greyish brown above, with a fine, white, vertebral line dividing into two above the vent and continuing along the thigh and tarsus. A white line from the eye along the canthus rostralis meets its fellow at the tip of the snout, and also extends backwards to above the shoulder, in some specimens widening out and continuing to the groin. A conspicuous broad dark band extends from the snout to the shoulder. There may be indistinct bands across the limbs. The lower parts are whitish.

Six specimens were examined; the dark line from the snout is present in all, but in two from Kia, Ysabel Island, the white vertebral line is absent. Four others from Ysabel Island have the vertebral stripe, and the dark lateral line is also present, but there is also an irregular semicircle of black spots on the back between the shoulders, while there may be indefinite shadings all over the dorsal surface.

Family CERATOBATRACHIDÆ.

Genus CERATOBATRACHUS *Boulenger.*

Ceratobatrachus Boulenger, Proc. Zool. Soc., 1884, p. 212. *Id.* Trans. Zool. Soc., xii, 1886, p. 56.

Main Characters.—Teeth in lower as well as upper jaw. Pupil horizontal. Tongue deeply notched and cordiform, extensively free behind. Vomerine teeth present. Head large, strongly ossified. Tympanum distinct. Fingers and toes free, tips not dilated. Outer metatarsals united. Precoracoids present; omosternum and sternum with a bony style. Terminal phalanges simple.

CERATOBATRACHUS GUENTHERI *Boulenger.*

(Fig. 8.)

Ceratobatrachus guentheri Boulenger, Proc. Zool. Soc., 1884, p. 212. *Id.* Trans. Zool. Soc., xii, 1886, p. 56, Pl. xii and xiii. *Id.* Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 94.

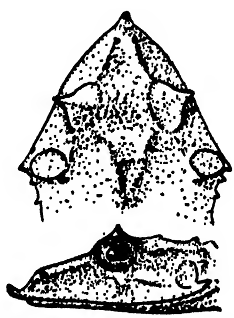

Fig. 8.—*Ceratobatrachus guentheri* Boulenger.

Main Characters.—Vomerine teeth in two small groups behind the level of the choanæ; the latter as large as the vomerines, while the eustachian tubes are larger still. Head triangular, broader than long, almost as large as the body, mouth enormous, stretching well behind the eye. Canthus rostralis distinct, obtuse; loreal region almost flat, sloping obliquely outwards. Interorbital space broad, deeply concave. Tympanum large, vertically elliptic. Skull with prominent ridges and a small, sharp, curved spine at the angle of the mouth. A prominent fold stretches from the posterior border of the eye over the shoulder.

The limbs are short and heavy; when the hind limb is stretched forward, the tibiotarsal articulation reaches to the posterior border of the eye, and the tips of the fingers, when the fore limb is produced backwards, reach to the vent. The digits are swollen at the tips and the subarticular tubercles are very prominent. The toes are free with a rudiment of web at the base. There are glandular folds on the upper surface of the back, while there are small, triangular dermal flaps on several parts of the body as follows:—tip of the snout, from each upper eyelid, behind the angle of the mouth, the hinder edge of each forearm, below the vent, and from the tibiotarsal articulation.

The colour is very variable and beautiful, as also are the markings of lines and blotches which adorn the upper surfaces. In some examples the under parts are uniform whitish, while in others the throat, breast, and under surface of the legs are very dark brown with white spots. Two conspicuous, white, nipple-like spines are present throughout the series.

A large series was examined, ranging from 15 mm. to 75 mm. in length, the specimens being mostly from the vicinity of Kia, Ysabel Island. One specimen, which was collected in September, 1884, by Captain Wolsch, and which measured 73 mm., had swallowed another frog, *Cornufer solomonis,* 50 mm. in length.

Family HYLIDÆ.

Main Characters.—Shoulder girdle not firmly united, chest expansible, upper jaw toothed. Diapophyses of sacral vertebræ dilated. Terminal phalanges claw shaped, swollen at the base.

Genus HYLA *Laurente.*

Hyla Boulenger, Brit. Mus. Cat. Batr. and Ecaudata, 1882, p. 338.

Main Characters.—Pupil horizontal. Tongue entire or slightly nicked, more or less free behind. Vomerine teeth present. Tympanum distinct or hidden. Fingers free, or more or less webbed; toes webbed, the tips dilated into large discs. Outer metatarsals united or only slightly separated. Omosternum cartilaginous; sternum a cartilaginous plate. Diapophyses of sacral vertebræ more or less dilated. Shoulder girdle overlapping, not firmly united, chest expansible.

HYLA THESAURENSIS *Peters.*

(Plate xiii, figs. 3-5, and Fig. 9.)

Hyla thesaurensis Peters, Monatsb. Akad. Wiss. Berlin, 1877, p. 421. *Id.* Boulenger, Brit. Mus. Cat. Batr. Ecaud., 1882, p. 409.

Hyla macrops Boulenger, Ann. Mag. Nat. Hist., (5), xii, 1883, p. 164. *Id.* Trans. Zool. Soc., xii, 1886, p. 59, Pl. xl, fig. 3.

Hyla lutea Boulenger, Proc. Zool. Soc. London, 1887, p. 337, Pl. xxviii, fig. 4.

Hyla thesaurensis Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 93.

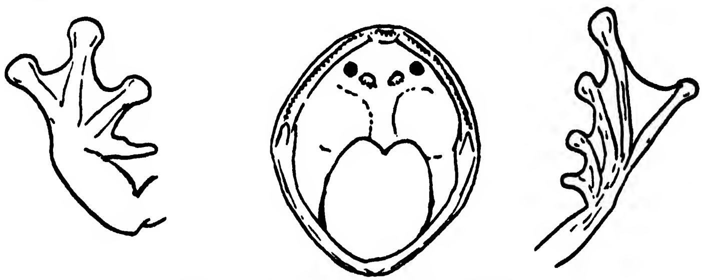

Fig. 9.—*Hylc thesaurensis* Peters.

Main Characters.—Tongue small, heart-shaped. Vomerine teeth in two transverse groups behind the level of the choanæ; the latter are longer than the eustachian tubes. Head depressed, snout rounded, about as long as the diameter of the orbit. Canthus rostralis more or less distinct, loreal region concave. Nostril nearer the tip of the snout than the eye. Eye large, interorbital space as broad as, or broader than the upper eyelid. Tympanum very distinct, circular, and about two-thirds to half the diameter of the eye. Toes more or less webbed and with small subarticular tubercles. One or two small flat metatarsal tubercles, the outer minute. No cutaneous tarsal fold. Discs of toes as large as or larger than the tympanum, those of the fingers a little smaller. Skin smooth above, lower surfaces with large flat granules. When the hind limb is stretched forward the tibiotarsal articulation reaches to the tip of the snout.

Colour.—Very variable; it may be referable in two varieties:

1. var. *thesaurensis.* Olive brown above with a broad white vertebral line from the tip of the snout to the coccyx, and another similar line on each side from the upper eyelid; a short white streak on the end of the snout, a curved transverse streak between the eyes, and another on each side of the head from below the nostril to the angle of the mouth. Lower surfaces whitish.

2. var. *macrops* (including *lutea*). Upper surfaces uniform green or lemon yellow, abdomen white, hinder side of thigh brown.

There may be a white line along the outer side of the forearm and fourth finger, and along the tarsus and fifth toe.

Distribution.—Treasury, Faro, Ysabel, New Georgia, Russel, Malaita and Gaudalcanar Islands.

It is fairly evident that the strong markings which were originally described as being typical of *thesaurensis,* belong to young specimens, and they disappear with age.

There are nine specimens in the Australian Museum.

Affinities.—In regard to the placing of *Hyla macrops* and *lutea* in the synonymy of *H. thesaurensis* by Dr. Barbour, I cannot do better than quote from his paper, in which he says: "Peters' type was a young specimen, 28 mm. in length. The measurements which Boulenger gave when he described *H. macrops* were: Male, 38 mm. and female 54 mm. in length, while later he stated *H. lutea* to be 67 mm. long. Boulenger himself was in doubt as to the validity of *macrops,* and (1886) inclined to consider it a colour variety only of *thesaurensis. H. lutea*, however, was said to have the fingers half webbed; while in *macrops* no web in the fingers is mentioned, and Peters also states that the fingers are free in *thesaurensis.* Boulenger mentioned a slight trace of finger web in the little 31 mm. long individual which in 1886 he called *thesaurensis.* The character seems to be variable, and while none of our specimens shows as much web as is drawn in his figure of *lutea,* nevertheless many of them do show a very considerable and a very variable degree of webbing. The types of *thesaurensis* and *macrops* both come from Treasury Island, and those of *lutea* from Faro, near by. Mann's booty shows that the species is very abundant and wide-ranging throughout the group . . . . A very variable series as to finger webs."

OPHIDIA.

Key to the genera (Fig. 10).

A. Worm-like blind snakes, eye under the head shields, mouth inferior, somewhat shark-like, teeth microscopic, few .... *Typhlops*

AA. Typical snakes, eyes well developed, mouth ordinary, teeth well developed.

- B. Body and tail cylindrical.
  - C. Scales keeled .... *Enygrus*
  - CC. Scales smooth.
    - D. Fangs at rear of maxillary bone, head very distinct from neck, Brown Tree snakes .... *Boiga*
    - DD. Fangs at front of maxillary bone, head not very distinct from neck.
      - E. Eye equal to distance from mouth .. *Denisonia*
      - EE. Eye minute, much less than distance from mouth .... *Micropechis*
    - DDD. No fangs, all teeth solid, Green Tree snakes .... *Dendrophis*
- BB. Body cylindrical, tail paddle-shaped .... *Laticauda*
- BBB. Body flattened laterally, tail paddle-shaped .... *Pelamydrus*

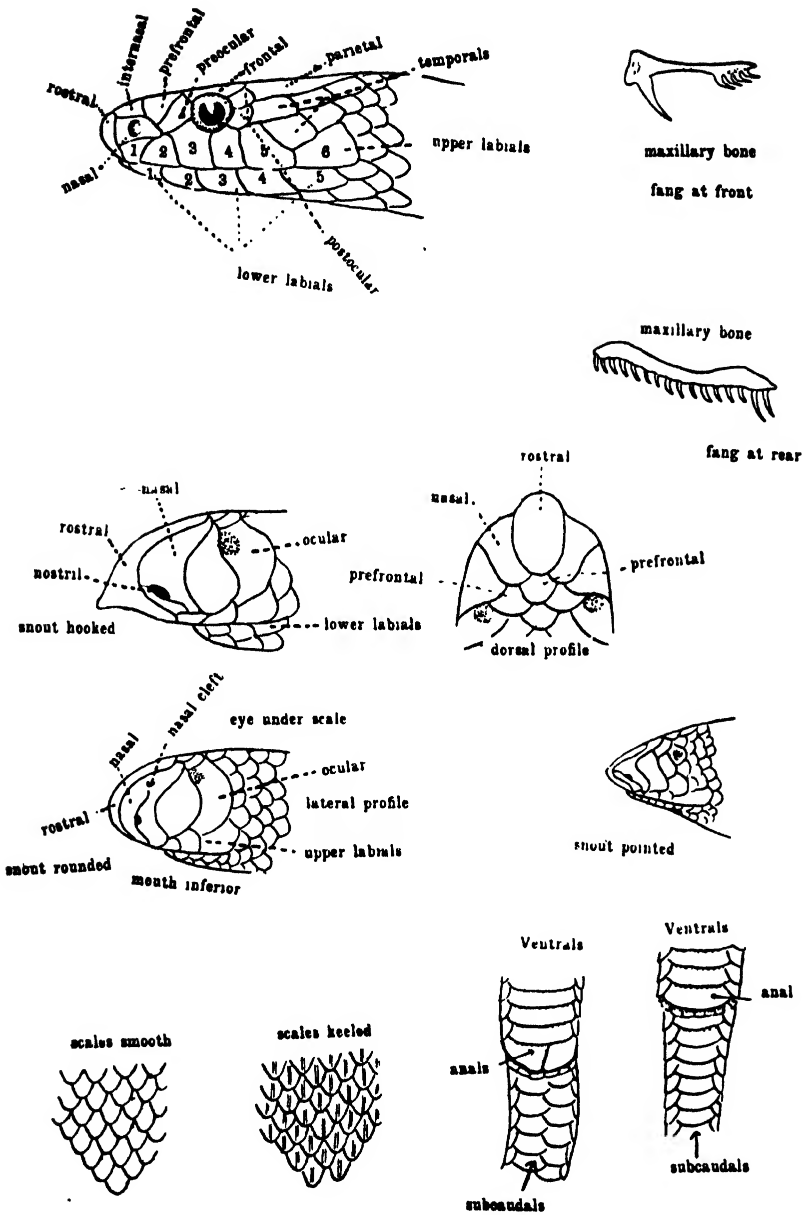

Fig. 10.—Guide to the Key to the Snakes.

Genus TYPHLOPS *Schneider.*

Typhlops Schneider, Hist. Amph., ii, 1801, p. 339.

Main Characters.—Worm-like blind snakes, eye under the head shields. Mouth inferior, somewhat shark-like. Body covered with uniform cycloid scales. Tail very short. Posterior portion of body usually thicker than the anterior.

Key to the species.

Snout rounded in lateral view, nostrils lateral, 22 rows of scales round body .... *alluensis*

Snout hooked in lateral view, nostrils inferior.

Snout trilobed in dorsal view, 20 to 22 rows of scales .... *olivaceus reduncus*

Snout rounded in dorsal view, 24 scales round body .... *cumingii* var. *mansuetus*

Snout sharp pointed in lateral and dorsal views, not hooked, 26 scales round body .... *infralabialis*

TYPHLOPS ALUENSIS *Boulenger.*

(Fig. 11.)

Typhlops aluensis Boulenger, Proc. Zool. Soc. London, 1887, p. 336, Pl. xxviii, fig. 2.

Main Characters.—Body elongated, of subequal diameter throughout. Snout depressed, rounded. Nasal completely divided; a preocular separates the nasal from the ocular, which rests on the third and fourth upper labials. Rostral rounded or slightly constricted posteriorly, its width about three-fifths the distance between the eyes. A small azygous shield separates the rostral from the mouth. Tail twice as long as broad at the base, tapering, ending in a spine.

Total length 245 mm., diameter of body 4 mm., length of tail 10 mm.

Holotype from Alu Island, Solomons. Described from a single specimen.

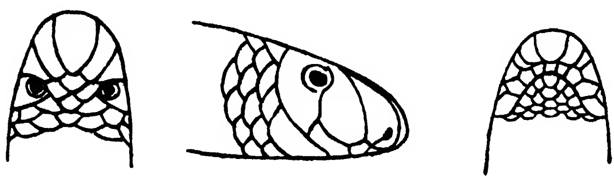

Fig. 11.—*Typhlops aluensis* Boulenger (after Boulenger).

General Notes.—Dr. Barbour received a specimen collected by Dr. Mann at Keri Keri, San Cristoval Island. In the Australian Museum collection there are five specimens, two being from the Fiji Islands.[2] Of the three from the Solomons, one is from the Government Station, Ysabel, one from Tulagi, and one without definite locality. All agree with Boulenger's original description. Boulenger's figure does not show the nasal to be completely divided, the error evidently being made by the artist.

TYPHLOPS OLIVACEUS *Gray.*

(Figs. 12-13.)

Onychophis olivaceus Gray, Brit. Mus. Cat. Liz., 1845, p. 133.

Onychocephalus olivaceus Peters, Monatsb. Akad. Wiss. Berlin, 1861, p. 684.

Typhlops (*Onychocephalus*) *angusticeps* Peters, Monatsb. Akad. Wiss. Berlin, 1877, p. 417, Pl. —, fig. 3.

Typhlops olivaceus Boulenger, Brit. Mus. Cat. Snakes, i, 1893, p. 50.

? *Typhlops olivaceus reduncus* Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 107, Pl. v.

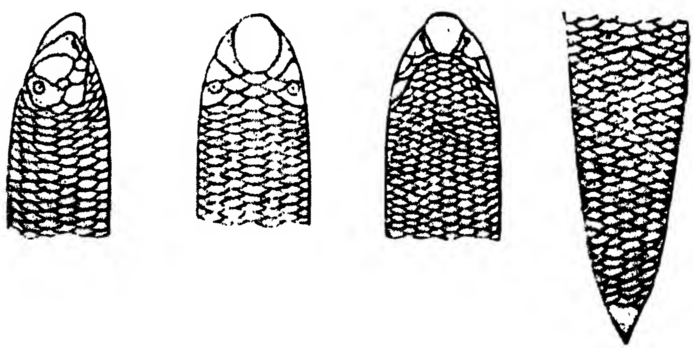

Fig. 12.—*Typhlops olivaceus* Gray (after Peters).

Main Characters.—Snout very prominent, slightly hooked, with a narrow subcrescentic, sharp, transverse edge. Nostrils inferior. Eye fairly distinct. Rostral large, its upper part longer than broad, and about three-fifths the width of the head, not extending to the level between the eyes, its lower part as broad as long. Nasal nearly completely divided, the cleft proceeding from the first labial. Preocular present, nearly as broad as the nasal or the ocular, in contact with the second and third labials. Prefrontal considerably enlarged; four upper labials. Diameter of body 50 to

[2] Waite.—Proc. Linn. Soc. N.S.W., xii, 1898, p. 685

68 times in the total length. Tail twice and a half as long as broad, ending in a spine. There are 20 to 22 scales round the body.

Colour pale brown above, lighter below. Total length 410 mm.

General Notes.—Dr. Barbour did not give a description of his subspecies, but merely recorded the characters by which he considered it differed from the typical form. He says: "Similar to the true *T. o. olivaceus* from the Philippines, which has been recorded also from the Moluccas and Australia, but with a much longer and more sharply produced rostral scale and a much more conspicuously developed ornamentation of excrescenses."

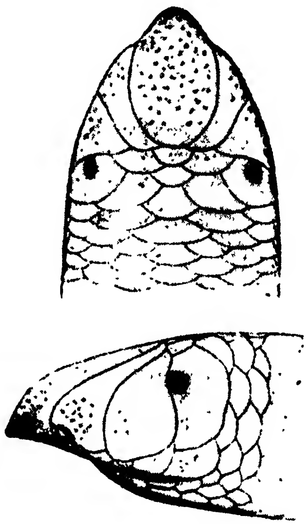

Fig. 13.—*Typhlops olivaceus reduncus* Barbour (after Barbour).

Miss Procter compared Barbour's drawings with specimens in the British Museum, and, judging by her remarks, she appears to be doubtful whether Barbour's specimens constitute a subspecies. Unfortunately no specimens are available to me, but, relying entirely upon the figures and descriptions available, and realizing that there is a considerable degree of variation in allied species, I prefer to place Barbour's subspecies in the synonymy. The same remarks also apply to the following species.

TYPHLOPS CUMINGII *Gray.*

(Fig. 14.)

Onychophis cumingii Gray, Brit. Mus. Cat. Liz., 1845, p. 133.

Onychocephalus cumingii, Boettger, Berl. Senck. Ges., 1886, p. 104.

Typhlops cumingii Boulenger, Brit. Mus. Cat. Snakes, i, 1893, p. 51, Pl. iii, fig. 4.

? *Typhlops cumingii mansuetus* Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 108, Pl. vi.

Main Characters.—Snout very prominent, not hooked, with or without the sharp subcrescentic transverse edge. Nostrils inferior. Eye distinct. Rostral large, its upper part longer than broad, and about half the width of the head, not extending to the level of the eyes; its lower part as broad as long. Nasal completely divided, the cleft proceeding from the second labial. Preocular present, narrower than the nasal or the ocular, in contact with the third labial only. Prefrontal large, parietals broad. Four upper labials. Diameter of body 48 to 52 times in the total length. Tail four or five times as long as broad, ending in a spine. There are 24 rows of scales round the body. Total length 365 mm. Olive brown above, yellowish below.

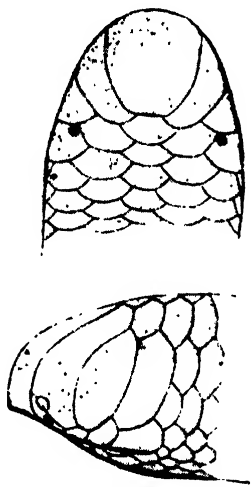

Fig. 14.—*Typhlops cumingii* Gray, *mansuetus* Barbour (after Barbour).

Distribution.—Philippine Islands to Solomon Islands. Barbour's subspecies *mansuetus* appears to be restricted to the Solomon group.

TYPHLOPS INFRALABIALIS *Waite.*

(Fig. 15.)

Typhlops infralabialis Waite, Rec. South Austr. Mus., i, 1, 1918, pp. 35-36, fig. 25.

Main Characters.—Head moderate, head and snout acute. Nostrils sublateral, nearer the rostral than to the anterior preocular. Eye indistinct. Rostral short and narrow, extending to two-thirds its distance from the level of the eyes. Nasal nearly

divided, the cleft extending to the hinder edge of the first labial. No supranasals. A large preocular, which does not touch the ocular. The normal position of the ocular represented by four scales. A small ocular, posterior ocular, subocular, and a supralabial, the latter wedged in between the third and fourth labials. Four upper labials and three supralabials. Jaw V-shaped, a small chin shield and a series of very narrow labials bordering the mouth. Diameter of body 52 times in its length; tail as broad as long, ending in a spine. Total length 315 mm. Brown above and yellow below.

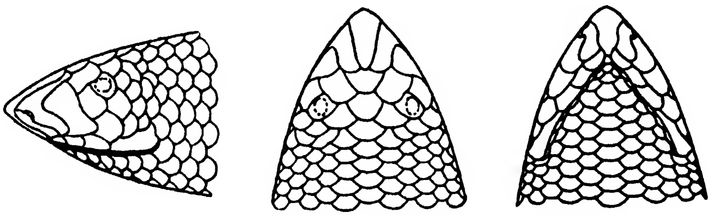

Fig. 15.—*Typhlops infralabialis* Waite (after Waite).

Type in Australian Museum Reg. No. R.4609, from Malaita, Solomon Islands.

ENYGRUS *Wagler.*

Enygrus Wagler, Syst. Amph., 1830, p. 166. *Id.* Boulenger, Brit. Mus. Cat. Snakes, 1893, i, p. 104.

Main Characters.—Anterior maxillary and mandibular teeth very large, the rest small and subequal. Head distinct from neck, covered with small scales. Snout prominent, obliquely truncate. Body slightly compressed, scales keeled, pupil vertical. Tail short, prehensile, subcaudals single.

Key to the species.

A. Upper labials entering the orbital area.
33-43 scales round the body, 38-56 subcaudals .... *carinatus*

AA. Upper labials not entering the orbital area, separated therefrom by a row of subocular scales.
31-33 scale rows, 50-58 subcaudals .... *bibronii*
33-39 scale rows, 15-21 subcaudals .... *asper*
41-42 scale rows, 51-62 subcaudals .... *australis*

ENYGRUS CARINATUS *Schneider.*

(Fig. 16.)

Enygrus carinatus Schneider, Hist. Amph., ii, 1801, p. 261. *Id.* Boulenger, Brit. Mus. Cat. Snakes, i, 1893, p. 107.

Main Characters.—Snout prominent, obliquely truncate, canthus rostralis angular. Rostral broader than deep, not visible

from above. Head covered with small scales which are either keeled or bear small tubercles. Three upper labials and a row of small scales, of which there are ten to fourteen, surrounding the eye and entering the orbital area. There are 5-10 scales between the eyes. Ten to thirteen upper labials. From 33 to 43 strongly keeled scales round the thickest part of the body. Ventrals from 160 to 200; anal entire; subcaudals 38-56.

The colour is very variable.

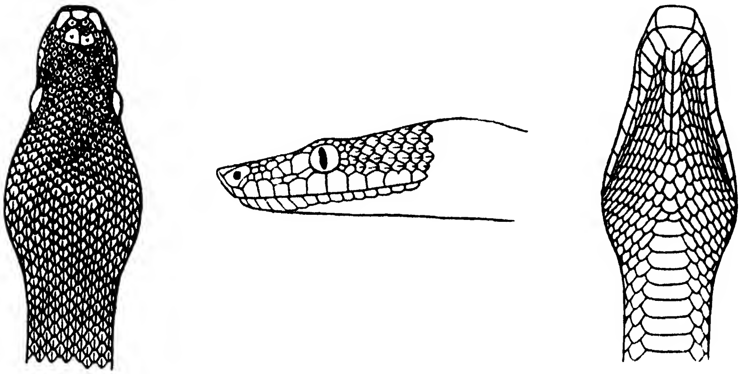

Fig. 16.—*Enygrus carinatus* Schneider (after Jan).

Distribution.—There are four specimens from Gaudalcanar, two being adult and two young, the latter being from 220 to 250 mm. in length. One of the adults is exceptionally dark coloured, the ventral surface being heavily spotted and blotched with black. Three specimens from Bougainville Island measure from 20 to 28 inches in length; one of these is very light brown, almost yellowish above, with diamond-shaped patches on the vertebral line, each diamond connected with a narrow dark brown band. In the collection are five from Ysabel Island, which could be placed nearest the variety *superciliosa,* two being from Kia and three from the Government Station, Tunabuli Harbour. The species is widely distributed throughout the group. It grows to 900 mm. in length, of which the tail may occupy 110 mm.

Mr. Heffernan advises me that this species is known as the Whip Snake on Karamulan Island, but the Whip Snake of Ysabel and perhaps other islands is probably the Green Tree Snake *Dendrophis.*

Enygrus bibronii *Hombron and Jacquinot.*

(Fig. 17.)

Enygrus bibronii, Hombron and Jacquinot, Voy. Pole. Sud, Zool., Rept. i, 1842, p. 18, Pl. i. *Id.* Boulenger, Brit. Mus. Cat. Snakes, i, 1893, p. 106.

Main Characters.—Snout prominent, obliquely truncate, canthus rostralis rounded. Rostral broader than deep, not visible from above. Head covered with small irregular scales, which may bear either tubercles or keels. There are 11 to 14 upper labials, those below the eye separated from it by a row of suboculars. From 31 to 33 rows of strongly keeled scales round the thickest part of the body. There are 10 to 14 scales between the eyes across the forehead. Ventrals from 210 to 225; anal entire; subcaudals 50 to 58.

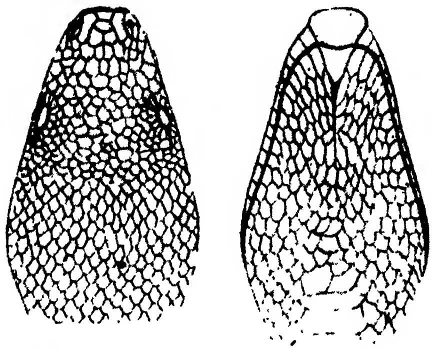

Fig. 17.—*Enygrus bibronii* Hombron and Jacquinot (after Hombron and Jacquinot).

This is a beautifully marked species; olive to greyish brown above, variously marked with brown, reddish or black spots, and stripes. The under parts are usually yellowish uniform or spotted and marbled with black. Total length 1,000 mm., tail 130 mm.

Distribution.—This species is widely distributed in the Solomons and occurs also in Fiji, Tonga, and the Friendly Islands.

Enygrus asper *Günther.*

(Fig. 18.)

Erybophis asper Günther, Proc. Zool. Soc. London, 1877, p. 132, Pl. xxi.

Enygrus asper Boulenger, Brit. Mus. Cat. Snakes, i, 1893, p. 109.

Main Characters.—Snout prominent, obliquely truncate, canthus rostralis angular. Rostral broader than deep, not visible from above. Head covered with small irregular scales, which have small tubercles or keels. There are 8 to 11 scales from eye to eye across the forehead. Eye surrounded by a circle of thirteen or fourteen scales. Ten or eleven upper labials, separated from the eye by the suboculars. Scales strongly keeled, the keels forming oblique lines. There are 33 to 39 rows of scales round the body. Ventrals 131 to 153. Anal entire. Subcaudals 15 to 21. Total length 730 mm., tail 55 mm.

Reddish brown above with a dorsal series of large dark brown black edged spots, the edges sometimes forming irregular lines across the body. Yellowish below, uniform or with dark brown spots.

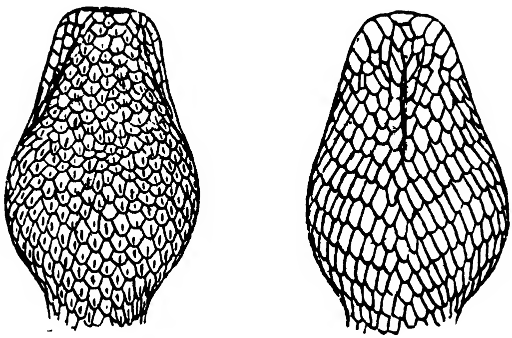

Fig. 18.—*Enygrus asper* Günther (after Günther).

Distribution.—There is a specimen in the Australian Museum from Bougainville Island; it was collected in 1917 and constitutes a new record for the distribution of the species, this being the first occasion on which it has been found in the Solomon group.

ENYGRUS AUSTRALIS *Montrouzier.*

Boa australis Montrouzier, Rev. et Mag. Zool., xii, 1860, p. 95. *Id.* Boulenger, Brit. Mus. Cat. Snakes, i, 1893, p. 105.

Main Characters.—Snout prominent, obliquely truncate, canthus rostralis rounded. Rostral broader than deep, not visible from above. Head covered with small, irregular, keeled, or nodular scales. There are 11 to 14 scales from eye to eye across the forehead. Eye encircled by fourteen to eighteen scales. Upper labials, 10-14, separated from the orbital space by the suboculars. Scales strongly keeled, in 41 to 42 rows round the thickest part of the body. Ventrals 232 to 252. Anal entire, subcaudals 51 to 62.

Colour and markings variable, usually reddish brown or olive above, with a dark brown vertebral line edged with yellow, or large dorsal spots. Zigzag lines on the sides of the body, a dark stripe along the side of the head and from eye to eye. Total length to about 1,130 mm., tail 140 mm.

Distribution.—Widely distributed throughout many of the north Pacific islands.

Genus BOIGA *Stejneger.*

Dipsadamorphis Boulenger, Brit. Mus. Cat. Snakes, iii, 1896, p. 59.

Boiga Stejneger, Proc. Biol. Soc. Wash., xv, 1902, p. 15.

Main Characters.—Body more or less compressed, head very distinct from neck. Maxillary teeth ten to fourteen, followed by two or three enlarged grooved fangs. Anterior mandibular teeth longest. Scales more or less oblique. Ventrals obtusely angulate laterally. Tail long, subcaudals in two rows.

BOIGA IRREGULARIS *Merrem.*

Coluber irregularis Merrem, in Bechst. Uebers. Lacép. iv, 1802, p. 239, Pl. xxxvii, fig. 1.

Dipsadamorphis irregularis Boulenger, Brit. Mus. Cat. Snakes, iii, 1896, p. 75.

Boiga irregularis Stejneger, Proc. Biol. Soc. Wash., xv, 1902, p. 15.

Main Characters.—Head very distinct from the neck. Rostral broader than deep, just visible from above. Internasals broader than long, much shorter than the prefrontals. Frontal as long as or a little longer than broad, as long as its distance from the rostral, shorter than the parietals. One or two preoculars in contact with, or narrowly separated from, the frontal. Eight to ten upper labials. Scales in 19 to 23 rows round the middle of the body, vertebral row moderately or strongly enlarged. Ventrals 217 to 270; anal entire or divided; subcaudals paired in 103 to 125 rows (some at irregular intervals may be single).

Colour very variable, usually brown above, crossed with irregular zigzag dark bars. Belly yellowish, uniform, or more or less spotted and speckled with brown.

Affinities.—After having examined a series of this species from the Solomon Islands and other places, I find that many of the characters are very variable. Two specimens from the Solomons which have about 234 ventrals, 110 subcaudals and each with 21 rows of scales round the body, also have a divided anal, a character which is typical of *B. philippinus*, but I have no hesitation in regarding them as *B. irregularis*, all other characters being typical of this species. It would appear that *B. philippinus* is founded on very slender grounds, and may yet prove to be merely a subspecies of *B. irregularis*.

Genus DENDROPHIS *Boie.*

Dendrophis Boie, Isis, 1827, p. 520. *Id.* Boulenger, Brit. Mus. Cat. Snakes, ii, 1894, p. 77.

Main Characters.—Head distinct from neck, more or less elongate. Maxillary teeth 20 to 26, the posterior ones more or less enlarged; stouter if not longer than the others. Body elongate, more or less compressed. Scales smooth, in 13 to 15 rows which are obliquely arranged, the vertebral row being more or less enlarged. Ventrals with a lateral keel and notch on each side, corresponding to the keel. Subcaudals in two rows, keeled and notched like the ventrals.

DENDROPHIS CALLIGASTER *Günther.*

(Fig. 19.)

Dendrophis calligaster Günther, Ann. Mag. Nat. Hist., (3), xx, 1867, p. 53. *Id.* Boulenger, Brit. Mus. Cat. Snakes, ii, 1894, p. 81.

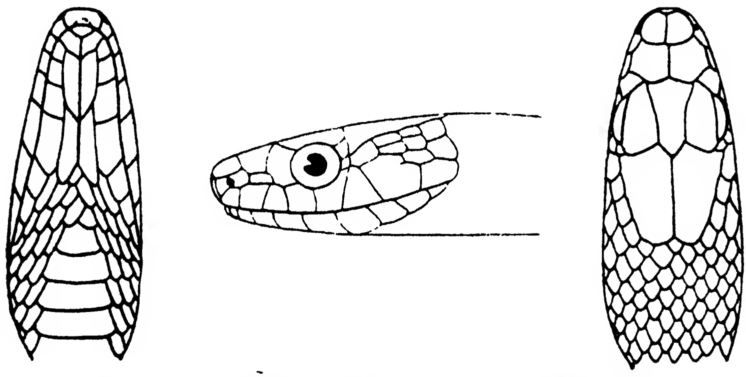

Fig. 19.—*Dendrophis calligaster* Günther (after Jan.).

Main Characters.—Head elongate, distinct from neck. Rostral once and two-thirds to twice as broad as deep, visible from above. Internasals about as long as the prefrontals. Frontal one and one-third to one and three-quarters as long as broad; as long as its distance from the rostral or the tip of the snout; shorter than the parietals. One preocular, two postoculars, temporals 2 + 2 or 1 + 2. Eight or nine upper labials, the fourth and fifth, or fifth and sixth under the eye. Five lower labials in contact with the anterior chin-shields. Maxillary teeth 20 to 26. Scales arranged in oblique rows round the body, the vertebrals enlarged, about as large as the last lateral row. Ventrals 176 to 211, anal divided, subcaudals 125 to 151.

Colour.—The colouration is very variable, and may be from bronzy olive to bright green above, and from greyish green to light yellow below. Some of the dorsal scales may have lighter and rather yellowish borders, while the ventrals may be spotted. A constant character is a blackish streak on each side of the head, passing through and sometimes well beyond the eye, and connecting with its fellow on the snout.

Genus MICROPECHIS *Boulenger.*

Micropechis Boulenger, Brit. Mus. Cat. Snakes, iii, 1896, p. 347.

Main Characters.—Maxillary extending forward as far as the palatine, the fangs followed by three small solid teeth. Anterior mandibular teeth longest. Head distinct from neck, eye minute, with round pupil. Nostril between two nasals; no loreal. Body cylindrical. Scales smooth, in 15 or 17 rows round the middle of the body; subcaudals in two rows.

MICROPECHIS ELAPOIDES *Boulenger.*

(Pl. xiv, fig. 1.)

Hoplocephalus elapoides Boulenger, Proc. Zool. Soc. London, 1890, p. 30, Pl. ii, fig. 3. *Id.* Waite, Rec. Austr. Mus., iii, 1899, p. 105.

Main Characters.—Head broad, not very distinct from the neck. Eye minute, not half as long as its distance from the mouth. Rostral much broader than deep, visible from above. Internasals two-thirds the length of the prefrontals. Frontal small, once and one-half to twice as broad as the supraocular, as broad as the prefrontal, as long as its distance from the rostral, shorter than the suture between the parietals. Posterior nasal in contact with the single preocular. Eye not much larger than the nasal aperture. Two small postoculars; temporals 1 + 2, seven upper labials, the third and fourth entering the eye, sixth largest. Four lower labials in contact with the anterior chin-shields which are as long as the posterior. Scales in 17 rows. Ventrals 208, anal entire; subcaudals 35 to 38.

Colour.—Cream coloured above and below, with 22 to 27 broad dark brown or black bands, which are broader than the interspaces between them; the bands not meeting on the belly, but completely encircling the tail. The first band may start on the neck, the parietal region being white, though a specimen in the Australian Museum has the parietal shields bearing a black patch. The rostral, ocular region, and upper labials are also black.

Type from Florida Island, Solomon group.

Genus DENISONIA *Krefft.*

Hoplocephalus, part, Günther, Brit. Mus. Cat. Col. Snakes, 1858, p. 213.

Denisonia Krefft, Proc. Zool. Soc. London, 1869, p. 321. *Id.* Boulenger, Brit. Mus. Cat. Snakes, iii, 1896, p. 332.

Main Characters.—Maxillary extending forward as far as the palatine, the fangs followed by three to five small solid teeth. Anterior mandibular teeth longest. Head not very distinct from

neck. Eye moderate, pupil round or vertically elliptic. Nasal divided, no loreal. Body cylindrical, scales smooth, without pits. Subcaudals single or paired.

Key to the species.

Subcaudals single, plain coloured, no cross bands .... *woodfordii*

Subcaudals paired, light and dark cross bars on body, 15-17 rows of scales .... *par*

DENISONIA PAR *Boulenger*.

(Pl. xiv, fig. 2, and Fig. 20.)

Hoplocephalus par Boulenger, Proc. Zool. Soc. London, 1884, p. 210 *Id.* Trans. Zool. Soc., xii, 1886, p. 46, Pl. vii, fig. 4.

Hoplocephalus melanurus Boulenger, Proc. Zool. Soc. London, 1888, p. 88, and 1890, p. 30, Pl. ii, fig. 1.

Denisonia melanura Boulenger, Brit. Mus. Cat. Snakes, iii, 1896, p. 345.

Denisonia par Boulenger, *loc. cit.*, p. 345.

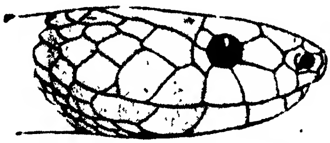

Fig. 20.—*Denisonia par* Boulenger (after Boulenger).

Main Characters.—Head more or less distinct from neck, eye about as long as its distance from the mouth. Rostral broader than deep, just visible from above. Internasals about half as long as the prefrontals. Frontal as long as, or a little longer than broad and twice as broad as the supraocular, a little longer than the prefrontals, about half as long as the parietals. Nasal divided, the posterior nasal in contact with the single preocular. Two postoculars; temporals 1 + 2. Seven upper labials, the third and fourth entering the orbit, the third deeper than the fourth, the sixth largest. Four lower labials in contact with the anterior chin-shields, which are shorter than the posterior. Body scales in 15 to 17 rows Ventrals 164 to 170. Anal divided. Subcaudals 40 to 49, single.

Colour.—Variable. Dark brown above with some of the scales black edged, or brownish above with more or less distinct cross bands, or reddish brown cross bands on a yellowish ground colour. In the latter case the colour and markings are somewhat similar to those of *Micropechis elapoides.* Ventrals yellow.

Affinities.—There are eight specimens in the Australian Museum collection, and on examination I find that the characters previously separating the two species, *melanura* and *par,* are variable and not reliable, and furthermore that there is considerable overlapping of these characters. Two specimens have 16 rows of scales, one has 15, one 17, and one 16 or 17 according to the position chosen somewhere near the middle of the body. The remaining characters of the specimens examined agree in detail with those given by Boulenger in his descriptions of *D. par* and *D. melanura.* The number of scale rows and the colour markings being the only differences between his two descriptions (although I have not been able to examine the types), I have little hesitation in placing *D. melanura* in the synonymy of *D. par.*

Distribution.—There are specimens in the Australian Museum collection from Melanta and Ysabel. The species is restricted to the Solomon group, particularly Faro Island, Howla Island, and Gaudalcanar Island.

DENISONIA WOODFORDII *Boulenger.*

(Pl. xiv, fig. 3.)

Hoplocephalus woodfordii Boulenger, Proc. Zool. Soc. London. 1888, p. 89, and 1890, p. 30, Pl. ii, fig. 2.

Denisonia woodfordii Boulenger, Brit. Mus. Cat. Snakes, iii, 1896, p. 346.

Main Characters.—Head more or less distinct from neck, eye about as long as its distance from the mouth. Rostral broader than deep, just visible from above. Frontal slightly longer than broad, nearly twice as broad as the supraocular, as long as its distance from the rostral, much shorter than the parietals. Nasal divided, the posterior nasal in contact with the single preocular. Two postoculars; temporals 1 + 2. Seven upper labials, the third and fourth entering the orbit. Four lower labials in contact with the anterior chin-shields, which are shorter than the posterior. Scales in 17 rows round the body. Ventrals 166 to 172. Anal divided. Subcaudals 41 to 45 pairs.

Colour.—Light brown above, each scale with a blackish brown border, forming a reticulate pattern. Head uniform dark brown. Lower parts white, the subcaudals edged with dark brown.

Distribution.—Evidently restricted to Rendora and New Georgia Islands, Solomon group.

Genus LATICAUDA *Laurente.*

Laticauda Laurente, Syn. Rept., 1768, p. 109.

Platurus Boulenger, Brit. Mus. Cat. Snakes, iii, 1896, p. 306.

Main Characters.—Body cylindrical, elongate, tail paddle-shaped. Maxillary bone extending beyond the palatine, with two

large poison fangs followed by one or two small solid teeth. Head shields large. Nostrils lateral, the nasals separated by internasals. Preocular present; no loreal. Scales smooth and imbricate, ventrals and subcaudals large.

LATICAUDA COLUBRINA *Schneider.*

(Fig. 21.)

Hydrus colubrinus Schneider, Hist. Amph., i, 1799, p. 238.

Platurus colubrinus Boulenger, Brit. Mus. Cat. Snakes, iii, 1896, p. 308.

Laticauda colubrina Stejneger, Bull. U.S. Nat. Mus., 58, 1907, p. 406.

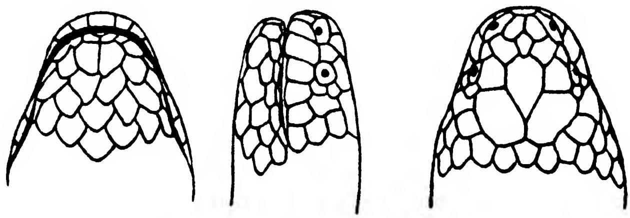

Fig. 21.—*Laticauda colubrina* Schneider (after Wall).

Main Characters.—Rostral deeper than broad. Frontal as long as, or slightly longer than, the parietals. One preocular and two postoculars. Six or seven upper labials the third and fourth under the eye. Temporals 1 + 2, sometimes 2 + 2. Scales in 21 to 25 rows round the middle of the body. Ventrals not keeled, 195 to 240; subcaudals 30 to 45.

Colour.—Olive above and yellowish below, with 28 to 54 black rings, which may completely surround the body or be interrupted on the belly.

This species is widely distributed from the Bay of Bengal to the western and south Pacific Ocean.

Genus PELAMYDRUS *Stejneger.*

Hydrus, part, Schneider, Hist. Amph., i, 1799, p. 233. *Id.* Boulenger, Brit. Mus. Cat. Snakes, iii, 1896, p. 266.

Pelamydrus Stejneger, Proc. U.S. Nat. Mus., xxxviii, 1910, p. 111.

Main Characters.—Body laterally compressed, tail paddle-shaped. Maxillary bone not extending forward as far as the palatine. Poison fangs short, followed by seven or eight small teeth. Snout long, head shields large; nostril superior, nasals in contact. One preocular, no loreal. Scales hexagonal, juxtaposed, no distinct ventrals.

Pelamydrus platurus *Linnæus.*

(Fig. 22.)

Anguis platura Linnæus, Syst. Nat., i, 1766, p. 391.

Hydrus platurus Boulenger, Brit. Mus. Cat. Snakes, iii, 1896, p. 267.

Pelamydrus platurus Stejneger, Proc. U.S. Nat. Mus., xxxviii, 1910, p. 111.

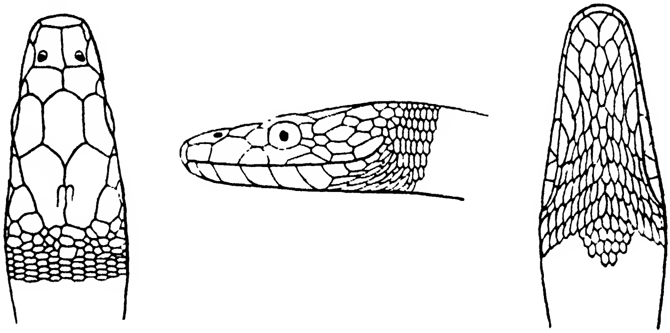

Fig. 22.—*Pelamydrus platurus* Linn. (after Stejneger).

Main Characters.—Head depressed, snout elongate. Frontal longer than its distance from the snout and nearly as long as the parietals. One or two preoculars and two or three postoculars. Seven to ten upper labials, the second largest in contact with the prefrontals. Three anterior temporals. Nasals in contact on the median line, nostrils on top of the snout, nasals longer than the prefrontals. Scales flat, hexagonal, juxtaposed, in 45 to 60 rows round the middle of the body. Body compressed laterally, tail paddle-shaped. Ventrals and subcaudals not distinct from the surrounding scales.

Colour.—Usually blackish above and yellowish below, tail spotted with black. The black markings are very variable, and the body may be more or less spotted or blotched.

This species grows to a length of about 42 inches, there being one of that size in the Australian Museum collection, though 30 inches is usually considered a large sized adult.

It is widely distributed throughout the tropical and temperate waters of the Indian and Pacfic Oceans.

LACERTILIA.

Key to the families (Fig. 23).

A. A strong dorsal crest of long spines .... *Agamidæ*
AA. No dorsal crest.
 B. Head and body covered with small granular scales.
  C. Snout short, depressed, rounded, tongue fleshy .. *Geckonidæ*
  CC. Snout long, angular, pointed, tongue rod-like, forked .... *Varanidæ*
 BB. Head covered with more or less regular plates, body with smooth scales .... *Scincidæ*

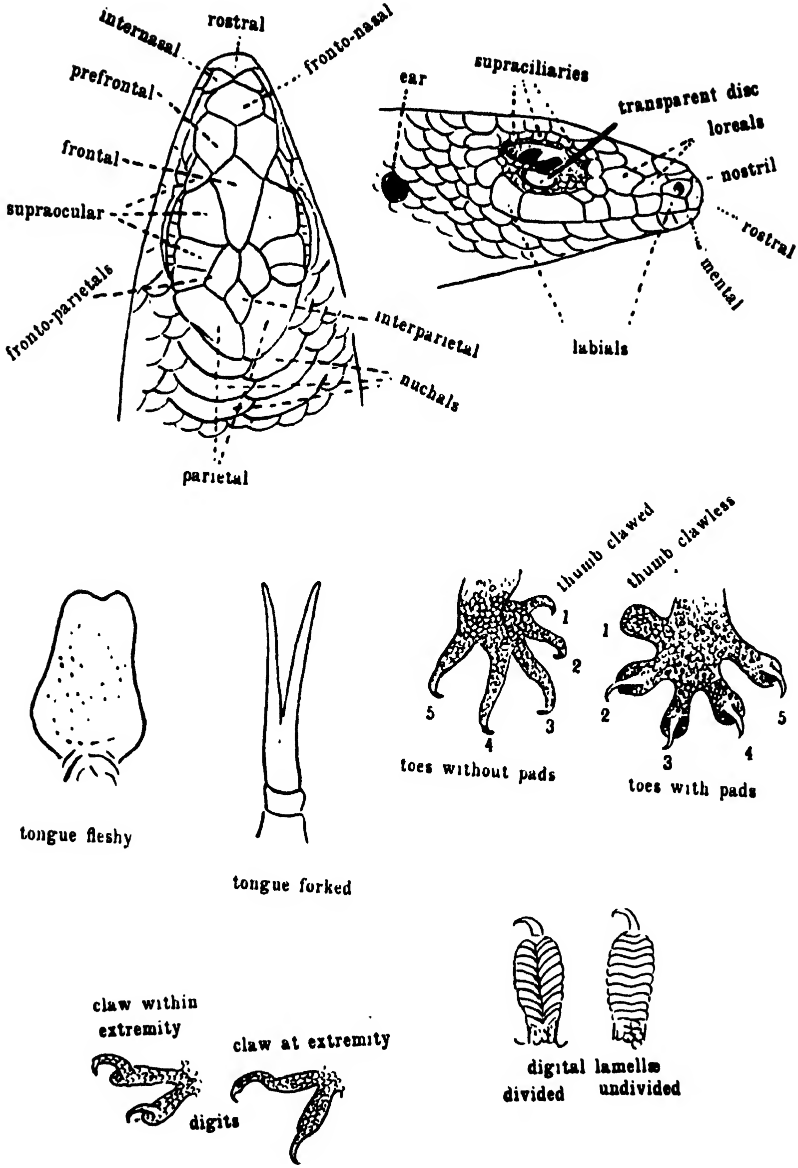

Fig. 23.—Guide to the Key to the Lizards.

Family AGAMIDÆ.

Genus Gonyocephalus *Kaup.*

Gonyocephalus Kaup., Isis, 1825, p. 590. *Id.* Boulenger, Brit. Mus. Cat. Liz., 1, 1885, p. 282.

Main Characters.—Tympanum distinct; body compressed. Body scales small, uniform or intermixed with enlarged ones. A strong nuchal and dorsal crest of elongated spines. Gular fold conspicuous. Males with a gular sack. No preanal or femoral pores.

The genus is distributed from the East Indies to Papuasia, N.E. Australia and the Solomon Islands.

Gonyocephalus godeffroyi *Peters.*

(Fig. 24.)

Lophura godeffroyi Peters, Mon. Akad. Wiss. Berlin, 1867, p. 707, Pl. —, fig. 1.

Gonyocephalus godeffroyi Boulenger, Brit. Mus. Cat. Liz., i, 1885, p. 295. *Id.* Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 102.

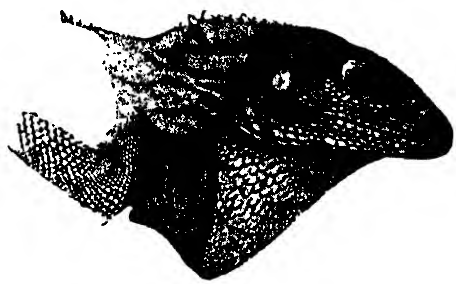

Fig. 24.—*Gonyocephalus godeffroyi* Peters (after Peters).

Main Characters.—Snout longer than the diameter of the orbit. Canthus rostralis and supraciliary edge angular, not projecting. Top of head concave. Tympanum larger than the eye opening. Scales on top of head minute, uniform in size, keeled; occipital scales enlarged. Ten to twelve upper and nine to ten lower labials. Gular sac large, not serrated anteriorly, median gular scales enlarged, smooth, posterior small, keeled. Nuchal crest separated from the dorsal by a notch. The longest spines of the nuchal crest equal the width of the tympanum. Dorsal crest longer than the nuchal crest, supported on greatly developed processes of the vertebræ. Crests much less developed in females and young specimens than in males. Dorsal scales small, keeled; ventrals larger, strongly keeled. Tail compressed, with a high crest on the basal portion.

Colour.—Dark brown, with more or less distinct cross bars. The young are greenish olive, either uniform or with darker cross bars.

Distribution.—There are sixteen specimens in the Australian Museum collection, and the characters are constant and show no variation from the above. Four are from Duke of York Island, two from Uji, four from St. Anna, two from Ysabel Island, one from Bougainville Island, three from the Solomons (no data). Dr. Barbour records this species from San Cristoval.

Family GECKONIDÆ.

Geckonidæ Boulenger, Brit. Mus. Cat. Liz., i, 1885, p. 3.

A very complete description of the family characters is given by Boulenger, but for the purpose of this paper all that is necessary is to give the most outstanding of the external features.

The snout is short, depressed and rounded. Eye large, with a vertical pupil, exposed, the valvular lids being rudimentary. Tympanum exposed. Tongue fleshy and only slightly nicked at the tip, and capable of protrusion from the mouth. Body more or less depressed, covered with granular scales on the dorsal surface. and small imbricate hexagonal ones on the lower surfaces.

Key to the genera.

Digits bent, claw shaped, without pads .... *Gymnodactylus*
Digits not claw shaped, with dilations or pads.
The distal joint long, free, rising from within the extremity of the digital expansion .... *Gehyra*
The distal joint at the extremity of the digital expansion.
A double series of sub-digital lamellæ .... *Lepidodactylus*
A single series of sub-digital lamellæ .... *Gecko*

Genus GYMNODACTYLUS *Boulenger*.

Gymnodactylus Boulenger, Brit. Mus. Cat. Liz., i, 1885, p. 22.

Digits bent, claw-shaped, cylindrical, without pads; the claw between two enlarged scales.

Key to the species.

16 to 20 rows of dorsal tubercles, back mottled, or with indefinite irregular cross bands .... *pelagicus*

26 rows of dorsal tubercles, back with large definite cross bands .... *louisiadensis*

GYMNODACTYLUS PELAGICUS *Girard*.

Heteronota pelagica Girard, Proc. Acad. Philad., 1857, p. 197.

Gymnodactylus pelagicus Boulenger, Brit. Mus. Cat. Liz., i, 1885, p. 40. *Id*. Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 100

Head large, oviform, depressed, snout longer than the distance from the eye to the ear. Forehead concave. Ear opening distinct, rounded, small. Body short, depressed. Head and upper surfaces covered with small granular scales, there being from 16 to 20 longitudinal series of conical, ribbed tubercles on the back. Rostral subquadrangular, not quite twice as broad as deep, with a median cleft above. Nostril pierced between the rostral, first upper labial, two nasals and two or three granules. Seven or eight upper and lower labials. Mental large, triangular, usually followed by a pair of chin-shields. Gular scales minute, granular; abdominal scales small, imbricate, keeled. Males usually with a series of eight preanal pores. Tail cylindrical, tapering, covered with small scales and occasional large tubercles.

Colour.—Brownish above, light below. There is usually a dark streak from the side of the snout through the eye to the ear, and irregular cross bands on the back. In some specimens the back may be slightly spotted with white and blotched with dark irregular bars. The lips are barred alternately with black and white markings.

There is a large series of this species in the Australian Museum collection from Australia, the islands of Torres Straits, New Guinea and many of the Pacific islands. Those from the Solomon group have been collected at the following localities: Hivo, N.E. Ysabel, Government Station, Ysabel.

GYMNODACTYLUS LOUISIADENSIS *De Vis.*

(Pl. xv, fig. 5, and Fig. 26.)

Gymnodactylus louisiadensis De Vis, Ann. Qld. Mus., 2, 1892, p. 11.

Gymnodactylus loriæ Boulenger, Ann. Mus. Civ. Genova; (2), xviii, 1897, p. 695, Pl. i.

Gymnodactylus olivii Garman, Bull. Mus. Comp. Zool., xxxix, 1901, p. 1, Pl. i, fig. 1.

Gymnodactylus louisiadensis Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 100. *Id.* Waite, Rec. Austr. Mus., vi, 1905, p. 13.

Main Characters.—Head large, much broader than the body, three-fourths as broad as long, depressed, the snout nearly one-third longer than the distance between the eye and the ear. Body convex. Digits compressed at the base, and strongly compressed at the distal portion, with ten to eleven transverse plates under the distal joint. Tail cylindrical, tapering, longer than the head and body. Rostral shield broader than high, with a median groove above. Nostril bordered by the rostral, nasal, first upper labial, and several granules. Mental large, pentagonal, the posterior border wedged in between a pair of chin-shields. Head minutely granular, the

granules longer on the snout and supraorbital region. Back with small granules, among which are from 24 to 26 rows of enlarged tubercles, those on the thighs and tail being the largest. Abdominal scales smooth, imbricate, the free edges rounded.

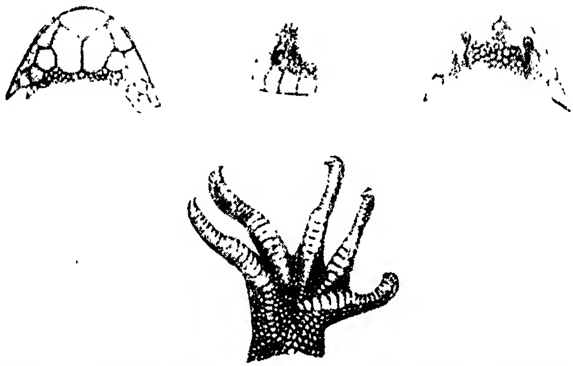

Fig. 26.—*Gymnodactylus louisiadensis* (after Garman).

Colour.—Pale brown above, the back being crossed by five or six darker bands, which are darkest on their outer borders. The first band extends from the snout through the eye, above the ear, and meets its fellow on the nape. The second crosses the body immediately in front of the fore limbs; there are three or four across the body between the limbs and one across the hips. The tail is crossed by similar bands, except in rejuvenated members, which are pale brown. The top of the head and snout is more or less mottled, and the whole of the underparts are whitish.

Distribution.—I have been able to examine several excellent specimens in the Australian Museum collection, only one of which is from the Solomon Islands. Two were collected in the year 1897 by Mr. G. Hislop near the Bloomfield River, Cooktown, Queensland, while another from Cooktown was presented to this Museum in 1908 by Mr. E. A. Olive. When the late Edgar R. Waite wrote doubting the Australian record from Cooktown he was not aware that in the "Old Collection," which was not catalogued at that time, were the three specimens mentioned above. Dr. Barbour has also recorded a specimen from the same locality. These records should set beyond doubt the occurrence of the species in Queensland.

Genus GEHYRA *Gray.*

Gehyra Boulenger, Brit. Mus. Cat. Liz., i, 1885, p. 147.

Main Characters.—Digits strongly dilated, free or webbed at the base, with undivided transverse lamellæ on the under surface. Distal phalanges free, elongate, clawed, laterally compressed, raised

from within the extremity of the dilated disc. Thumb and inner toe clawless, and without free distal phalange. Back covered with granular scales, abdomen with cycloid imbricate scales. Pupil vertical; males with femoral pores.

Distribution.—The genus is distributed from the East Indies and islands of the Indian and south Pacific Oceans to Australia and the west coast of Mexico, South America.

GEHYRA OCEANICA *Lesson.*

(Fig. 27.)

Gecko oceanicus Lesson, Voy. "Coquille," Zool., ii, 1830, p. 42, Pl. ii, fig. 3.

Gehyra oceanica Gray, Zool. Miscell., 1842, p. 58. *Id.* Boulenger, Brit. Mus. Cat. Liz., i, 1885, p. 152. *Id.* Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 101.

Fig. 27.—*Gehyra oceanica* Lesson (after de Rooij). Fore limb.

Main Characters.—Head much longer than broad, depressed. Snout once and one-half as long as the distance from the eye to the ear. The ear is oval, horizontal and equal in length to the distance between the orbits. Forehead with a distinct median groove. Body depressed, limbs stout, digits short, expanded into discs, the inferior transverse lamellæ not divided, but distinctly incurved. The distal joint long, free, rising from within the extremity of the digital expansion. The upper surfaces are covered with small, granular, juxtaposed scales, smallest on the neck. The scales are globular on the back, flat and subimbricate on the tail. Tail rounded, tapering, slightly depressed, and generally with a median groove on the dorsal surface. Femoral pores in an angular series, thirteen to twenty on each side.

Colour.—Brown above, uniform, or with darker or lighter markings and whitish spots. Lower surfaces creamy white.

Distribution.—This species is widely distributed throughout the Pacific islands. In the Australian Museum collection is a very large and unvarying series, the specimens being from the following localities: Ysabel and Gaudalcanar Islands in the Solomon group; New Hebrides; Duke of York Island; South East Cape, Papua; Murray Island, Torres Straits; Bismarck Archipelago; Samoa; Ocean Island; Funafuti, Ellice group; and Flint Island. The latter appears to be a new record, and is perhaps the furthest east that the species occurs. Flint Island is situated 151° 15′ west long.. 11° 26′ south lat. The specimen before me does not vary from the typical forms. The collection contains, also, one specimen from Lord Howe Island, and two from the mainland of Australia, one of which is from Albany Rock, Queensland.

Genus LEPIDODACTYLUS *Fitzinger.*

Lepidodactylus Fitzinger, Syst. Rept., p. 98; *Id.* Boulenger, Brit. Mus. Cat. Liz., i, 1885, p. 162.

Main Characters —Digits dilated, with or without a rudiment of web at the base. The inferior transverse lamellæ divided by a median groove. A short, compressed, clawed distal joint rising from the extremity of the digit. Inner digit clawless. Body covered with granular scales on the back, and juxtaposed or subimbricate ones on the under surfaces. Pupil vertical. Males with preanal or femoral pores.

Key to the species.

Digits webbed at the base, general colour brownish above, sides with dark spots .... *guppyi*

Digits without distinct webs, body grey, with zigzag black cross bands .... *woodfordii*

LEPIDODACTYLUS GUPPYI *Boulenger.*

(Fig. 28.)

Lepidodactylus guppyi Boulenger, Proc. Zool. Soc. Lond., 1884, p. 210. *Id.* Trans. Zool. Soc. Lond., xii, 2, 1886, p. 38, Pl. vii, fig. 1.

Main Characters.—Head small, slender, oviform, its length being contained four times in the distance between the end of the snout and the vent. Body narrow, contained about six times in the distance between the snout and the vent. The limbs are moderate; the digits are united at the base by a small web and are strongly dilated. There are eleven lamellæ under the median digit, the two or three under the proximal joint being divided, the others undivided. Rostral quadrangular, more than twice as broad as high. Nostril pierced between the rostral, the first upper labial and the nasals. There are eleven or twelve upper and lower labials, and three or four rows of small chin-shields. Tail cylindrical, tapering, covered

with small, equal flat scales. Head and body covered with uniform small granules above, minute on the occiput, largest on the snout.

Colour.—The upper surfaces are pinkish brown, with indistinct darker dots on the back, more distinct on the sides and limbs. An ill-defined dark streak extends from the end of the snout to the ear, passing through the orbit. The upper lip is pink, with brown spots. Tail with dark annuli above. The lower surfaces are whitish, except for the throat, which is finely dotted with reddish brown.

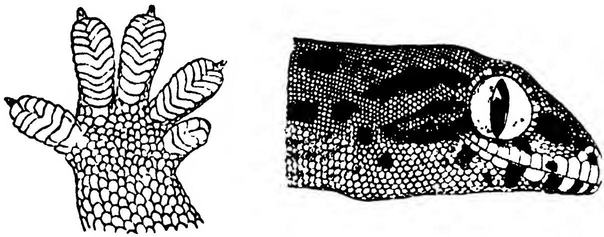

Fig. 28.—*Lepidodactylus guppyi* Boulenger (after de Rooij).

Boulenger states that the unique specimen from which the species is described is a female, and shows no femoral or preanal pores, but the enlarged scales on those regions indicate that both kinds of pores are developed in the males.

Length of type, 48 mm. from snout to vent; head 12 mm., tail 45 mm.

Locality.—Faro Island, Solomon group.

No specimen available to me.

LEPIDODACTYLUS WOODFORDII *Boulenger.*

(Pl. xiii, fig. 2.)

Lepidodactylus woodfordii Boulenger, Proc. Zool. Soc. Lond., 1887, p. 334.

Main Characters.—The following short description is given in the above paper: "Closely allied to *L. guppyi.* Digits without distinct web. Tail a little depressed, rounded. Femoral and preanal pores 25 altogether. Grey above, with zigzag black cross bands, six between the nape and the base of the tail; a black streak from the nostril to the neck, passing through the eye and above the ear: lower surfaces whitish." Boulenger also gives the following measurements: total length 78 mm., head 11 mm., width of head 7 mm., tail 38 mm.

Locality.—Described from a single specimen from Faro Island.

No specimen available to me.

Genus GECKO *Laurenti.*

Gekko, part, Laurenti, Syn. Rept., 1768, p. 44.

Gecko Boulenger, Brit. Mus. Cat. Liz., i, 1885, p. 182.

Main Characters.—Digits strongly dilated, more or less webbed at the base. Digital lamellæ undivided. Thumb clawless. Body covered with juxtaposed granular scales, with which are mixed many irregularly placed tubercles. Belly with small, flat, imbricate scales. Pupil vertical. Males with preanal and femoral pores.

Distribution.—The genus is distributed from China through the East Indies to New Guinea and the Solomon Islands.

GECKO VITTATUS *Houttuyn.*

Gecko vittatus Houttuyn, Verh. Zeeuw. Gen. Vlissingen ix, 1782, p. 325, Pl. —, fig. 2. *Id.* Boulenger, Brit. Mus. Cat. Liz., i, 1885, p. 185. *Id.* Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 101.

Main Characters.—Head oviform, snout longer than the distance between the eye and the ear, equal to the greatest width between the orbits. Forehead concave, ear oval, vertical, about as large as the pupil, its greatest diameter about half that of the orbit. Body slightly depressed, elongate; limbs long, the digits greatly expanded and slightly webbed. Head covered with small granular scales, slightly larger than those on the back. Nostril small, bordered by the rostral, nasal, and first labial. There are ten to fourteen upper and ten to twelve lower labials. Mental small, subtriangular, no chin-shields. Chin and throat covered with small granules, among which are larger tubercles. Scales of back minute, granular, intermixed with many larger, smooth, or slightly keeled tubercles. Femoral and preanal pores present. Tail slender, slightly depressed, distinctly annulate, covered above with small flat granules and larger tubercles, there being about twelve rows of scales above and five below, between the annuli. Under surfaces of body covered with smooth imbricate scales.

Colour.—Greyish to reddish brown above, variegated with darker markings and a light, dark edged, vertebral stripe which is forked on the neck. Tail with distinct white annuli. Under surfaces whitish. Some of the specimens examined are uniform brownish above, without distinctive markings.

Distribution.—This species is distributed from the Moluccas through New Guinea to the Solomon group. In the Macleay Museum, Sydney, are four specimens from the Solomons, while in the Australian Museum are thirty-three specimens from the following localities: Paniete, Louisiade Archipelago; New Britain; Humboldt Bay, Dutch New Guinea; Fife Bay, Papua; Duke of York Island; Maroom, Bismarck Archipelago; Gaudalcanar, Santa Anna, Uji, Howla, and Bougainville Islands in the Solomon group.

Family VARANIDÆ.

Genus VARANUS *Merrem.*

Varanus Merrem, Tent. Syst. Amph., 1820, p. 58. *Id.* Boulenger, Brit. Mus. Cat. Liz., ii, 1885, p. 304.

Main Characters.—Tongue smooth, rod-like, bifid, retractile into a sheath at its base. Head long, pointed, covered with small polygonal scales. Eyelids well developed. Ear opening distinct. Limbs well developed. Dorsal scales smooth, round, juxtaposed, surrounded by rings of minute granules. Ventral scales rather square, juxtaposed, flat, arranged in transverse rows. Tail very long, laterally compressed. No femoral or preanal pores.

Distribution.—The genus is distributed from Africa through Asia to the Australian region.

VARANUS INDICUS *Daudin.*

(Fig. 29.)

Tupinambus indicus Daudin, Rept., iii, 1802, p. 46, Pl. xxx.

Varanus indicus Boulenger, Brit. Mus. Cat. Liz., ii, 1885, p. 316.

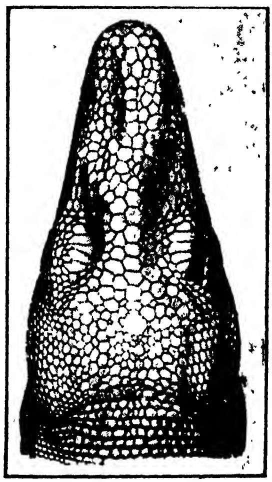

Fig. 29.—*Varanus indicus* Daudin (after Peters and Doria).

Main Characters.—Snout long, depressed at the tip, the distance from the tip to the eye being about equal to the distance from the anterior border of the eye to the ear opening. Canthus rostralis acute. Nostril round, nearer to the tip of the snout than to the eye. Scales of head comparatively large, larger on the forehead

than on the temples. Supraoculars transversely dilated. Dorsal scales small, oval, keeled; abdominal scales smooth, squarish, in 90 to 110 transverse rows. Tail strongly compressed, keeled above, all caudal scales keeled.

Colour.—The colour varies considerably. It may be olive brown to blackish above, with small yellow spots all over the body, or widely spaced larger ones, while the tail may bear more or less distinct cross bands and reticulations.

There is a large series of specimens in the Australian Museum collection from the Solomon Islands and other places.

Family SCINCIDÆ.

Key to the genera.

Palatine bones separated on the median line of the palate. Head very distinct from neck, squarish, snout as deep as broad, loreal region perpendicular, angular .... *Corucia*

Palatine bones in contact on the median line of the palate. Head not very distinct from neck, angular, snout depressed, loreal region usually oblique, rounded .... *Lygosoma*

Genus Corucia *Gray*.

Corucia Gray, Proc. Zool. Soc. Lond., 1885, p. 217. *Id.* Boulenger, Brit. Mus. Cat. Liz., iii, 1887, p. 141.

Main Characters.—Palatine bones not meeting on the middle line of the palate. Eyelids well developed, scaly. Tympanum distinct, deeply sunk. Nostril pierced in the single nasal; no supranasals. A complete series of shields between the orbit and the upper labials. Prefrontals well developed. Frontoparietals and interparietal distinct, the latter shield in contact with an azygous occipital. Limbs well developed, pentadactyle; digits slightly compressed, with undivided transverse lamellæ inferiorly. Tail prehensile. Loreal region perpendicular, angular.

Distribution.—As far as is known the genus is restricted to the Solomon Islands.

Corucia zebrata *Gray*.

(Fig. 30.)

Corucia zebrata Gray, Proc. Zool. Soc. Lond., 1885, p. 218, Pl. viii. *Id.* Boulenger, Trans. Zool. Soc. Lond., xii, 1886, p. 43, Pl. vii, fig. 3. *Id.* Boulenger, Brit. Mus. Cat. Liz., iii, 1887, p. 142. *Id.* Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 102.

Main Characters.—Head large, angular, distinct from neck. Snout short, rounded. Frontonasal the largest head shield. Prefrontals forming a median suture. Frontal small, broader than

long. Five band-like supraoculars, the second largest, the third and fourth bordering the eye. Interparietal larger than the frontal, and almost as large as the parietals. Two very large temporals, the upper largest. Ear opening without distinct lobules, and nearly as large as the orbit. The head shields are liable to slight variation in shape and size. Body scales large, those on the back being largest, and slightly keeled; there are from 36 to 38 rows round the middle of the body. The adpressed limbs overlap. Digits short, strong and provided with powerful claws. The two inner toes are very much larger than the outer three. Tail prehensile, a little longer than the head and body, cylindrical and with an obtuse end.

Fig. 30.—*Corucia zebrata* Gray (after Boulenger).

Colour.—Greenish white above with irregular dark brown cross bands, or olive above with lighter variegations, and there may be blackish spots irregularly spaced. The head is uniformly coloured, sometimes a reddish brown. The under surfaces of the body are greenish white.

Distribution.—There are four specimens in the Australian Museum collection. One was collected on Uji and two on St. Anna Islands in June, 1883, or some two years before Gray described the genus as new. The fourth specimen is from the south coast of Ysabel Island, and is twenty-seven and three-quarter inches in length.

Habits.—In regard to the habits of *Corucia zebrata*, Mr. Heffernan sent me the following interesting note: "*One large leaf eating lizard*: leads the same kind of life as the opossum, feeding at night only and sleeping in hollow trees during the day; often found asleep with the opossum. Western natives assert that if there is more than one of these lizards in the same hollow tree, the topmost one only comes out to feed, the others underneath remaining and feeding on the excreta of the top one, which is always very fat and healthy, the second one being thinner, and the third very thin.. This species is edible."

The stomach of the specimen from Ysabel Island contained a mass of particles of leaves cleanly cut into discs.

Genus LYGOSOMA *Gray.*

Lygosoma Gray, Boulenger, Brit. Mus. Cat. Liz., iii, 1887, p. 209.

Main Characters.—Palatal bones in contact on the middle line of the palate. Palatal notch not extending forward to the level of the centre of the eye. Eyelids well developed. Ear distinct or hidden, if distinct, tympanum more or less sunk. Nostril pierced in the nasal; supranasal present or absent. Limbs more or less developed, rudimentary or absent. Loreal region usually rounded.

Distribution.—The genus has a wide distribution from Africa through India and China to America, Australia and the Pacific islands.

As the genus *Lygosoma* is a very large one, the following key to the subgenera or sections will enable workers to distinguish them more readily.

A. Lower eyelid scaly, no transparent disc.
B. Limbs well developed.
C. Preanal scales enlarged .... *Hinulia*
CC. Preanal scales not enlarged .... *Dasia*
BB. Limbs not well developed, rudimentary .... *Riopa*
AA. Lower eyelid with an undivided transparent disc surrounded by scales.
D. Supranasals present .... *Emoa*
DD. Supranasals absent .... *Liolepisma*

Section HINULIA.

Main Characters.—Lower eyelid scaly. Limbs well developed, pentadactyle, the length of the hind limb greater than the distance from the centre of the eye to the fore limb. Tympanum distinct No supranasals. Frontal not broader than the supraocular region. Frontoparietals distinct. Preanal scales enlarged.

Key to the species of *Hinulia.*

24-26 rows of scales round body, 4-6 pairs of enlarged nuchals, 15-17 lamellæ under fourth toe .... *solomonis*

34 rows of scales round body, no enlarged nuchals, 18 lamellæ under the fourth toe .... *woodfordi*

40-42 rows of scales round body, no enlarged nuchals, 20-25 lamellæ under fourth toe .... *concinnatum*

LYGOSOMA (HINULIA) SOLOMONIS *Boulenger.*

(Pl. xv, fig. 4.)

Lygosoma solomonis Boulenger, Proc. Zool. Soc. London, 1887, p. 334. *Id.* Brit. Mus. Cat. Liz., iii, 1887, p. 510.

Sphenomorphus solomonis Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 105.

Main Characters.—Body elongate, limbs short. The distance between the end of the snout and the forelimb is contained once and three-fifths to once and two-thirds in the distance between the axilla and the groin. Snout short, obtuse. Lower eyelid scaly. Nostril pierced in a single nasal; no supranasal, a single anterior loreal. Frontonasal broader than long, forming a narrow suture with the rostral and with the frontal. Frontal about as long as the frontoparietal and interparietal together, and in contact with the first and second supraoculars. Seven supraciliaries. Frontoparietals and interparietal distinct, the latter a little smaller than the former. Parietals forming a suture behind the interparietal, and bordered by four to six pairs of nuchals. Fourth or fifth upper labial behind the eye and entering the orbit. Ear opening oval, a little smaller than the eye opening; no auricular lobules. Scales smooth, in 22 to 26 rows round the middle of the body, the two vertebral series largest. Preanal scales enlarged. Limbs widely separated when adpressed; the length of the hind limb equals the distance between the anterior border of the orbit and the fore limb. Digits short, subdigital lamellæ smooth, undivided, 15 to 21 under the fourth toe. Tail thick, once and one-third the length of the head and body.

Colour.—Brown above, with blackish dots. The under surfaces are pale brown, dotted with a darker shade.

The lengths of the specimens examined range from 80 mm. to 140 mm. from snout to tip of tail.

Distribution.—This species has not been found outside the Solomon Islands. Boulenger recorded it from Faro Island; Barbour from Auki, Malaita; while Heffernan collected for this Museum six specimens, two from Hivo, three from the Government Station, both on Ysabel Island, and one from the south-west of this island.

LYGOSOMA (HINULIA) WOODFORDI *Boulenger*.

(Pl. xv, fig. 2.)

Lygosoma woodfordi Boulenger, Proc. Zool. Soc. London, 1887, p. 335. *Id.* Boulenger, Brit. Mus. Cat. Liz., iii, 1887, p. 511, Pl. xxv, fig. 4.

Sphenomorphis woodfordi Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 105.

Main Characters.—Body elongate. Limbs rather short. The distance between the end of the snout and the fore limb is contained once and three-fifths in the distance between the axilla, and the groin. Snout moderately elongate, truncate. Lower eyelid scaly. Nostril pierced in a single nasal, no supranasal; a single loreal Rostral forming a broad, straight suture with the frontonasal,

which is broader than long. Prefrontals forming a median suture. Frontal as long as the frontoparietals and interparietal together, in contact with the first supraciliary and the two anterior supraoculars. Four supraoculars followed by a very small fifth, first longest. There are ten supraciliaries, the first largest. Frontoparietals and interparietal distinct, the former much larger than the latter. Parietals forming a suture behind the interparietal. No nuchals. Nine upper labials, the seventh below the centre of the eye. A series of rather large suborbitals separates the orbit from the labials. Ear opening oval, a little smaller than the eye opening, no auricular lobules. Scales smooth, in 34 rows round the middle of the body; dorsals largest, the laterals very small. A pair of enlarged preanals. The adpressed limbs just meet. Digits rather short, slightly compressed; there are 18 smooth lamellæ under the fourth toe.

Colour.—Dark brown above with a strong metallic gloss. The sides bear curved or oblique black bars. The lower surfaces are yellowish. Boulenger's type, the species being described from a single specimen, measures 166 mm., total length.

Distribution.—Restricted to the Solomon Islands, the type coming from Faro Island. Barbour records one from Uji and six from Wainone Bay, San Cristoval. There are no specimens in the Australian Museum.

LYGOSOMA (HINULIA) CONCINNATUM *Boulenger.*

(Pl. xv, fig. 1, and Fig. 31.)

Lygosoma concinnatum Boulenger, Proc. Zool. Soc. Lond., 1887, p. 335. *Id.* Brit. Mus. Cat. Liz., iii, 1887, p. 511, Pl. xxvi, fig. 4.

Sphenomorphus concinnatus Barbour, Proc. New Eng. Zool Club, vii, 1921, p. 105.

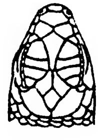

Fig. 31.—*Lygosoma (Hinulia) concinnatum* Boulenger (after Boulenger).

Main Characters.—Habit lacertiform. The distance from the end of the snout to the fore limb is equal to about one and one-fifth to one and one-fourth the distance between the axilla and the groin. Snout short, obtuse. Supraocular regions swollen. Lower eyelid scaly. Nostril pierced in a single nasal; no supranasal, a single anterior loreal, or a very small shield above it. Rostral forming a broad, straight suture with the frontonasal, which is much broader

than long. Prefrontals forming a median suture. Frontal much narrowed posteriorly, as long as, or shorter than the frontoparietals and interparietal together, in contact with the first and second supraoculars. Four supraoculars, the first longest. Eight or nine supraciliaries, first largest. Frontoparietals and interparietal distinct, the former longer than the latter. Parietals forming a suture behind the interparietal. No enlarged nuchals. Fifth upper labial largest and situated below the orbit. Ear opening oval, nearly as large as the eye opening, no auricular lobules. Scales smooth, or dorsals and laterals indistinctly pluricarinate, laterals smallest, disposed in 40 to 42 rows round the middle of the body. A pair of enlarged preanals. The hind limb reaches to the elbow or the axilla of the adpressed fore limb. Digits rather elongate, slightly compressed, subdigital lamellæ smooth, 22 to 25 under the fourth toe. Tail about once and one-half the length of the head and body.

Colour.—Dark brown above with a strong metallic gloss. Back spotted with black and whitish spots elegantly arranged. There is a black band on each side of the head, passing through the eye and sometimes becoming diffused behind the eye. A large and conspicuous white-edged black spot is usually present on the sides of the neck. Lower surfaces brownish white, clouded, or longitudinally streaked with a darker.

Distribution.—The species is restricted to the Solomon group and has been recorded from Faro Island, New Georgia, Malaita, Tulagi, and there are ten specimens in the Museum collected by Mr. Heffernan from the Government Station, Ysabel Island.

Section DASIA.

Main Characters.—Lower eyelid scaly. Limbs well developed, pentadactyle, overlapping when adpressed, digits compressed distally. Ear opening small, but distinct. Frontal not broader than the supraocular region. Frontoparietals distinct. Supranasals present or absent.

LYGOSOMA (DASIA) SMARAGDINUM *Lesson.*

(Pl. xiii, fig. 1.)

Scincus smaragdinus Lesson, Voy. "Coquille," Zool. ii, 1830, p. 43, Pl. iii, fig. 1.

Lygosoma smaragdinum Boulenger, Brit. Mus. Cat. Liz., iii, 1887, p. 250.

This species has been divided into several subspecies or geographical races by several authors, Dr. Barbour listing them for the convenience of other workers. This splitting up has been done on colour and markings, which appears to be quite a distinctive feature of the specimens from different geographical areas.

Dasia smaragdinum perviridis *Barbour.*

Dasia smaragdinum perviridis Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 106.

Main Characters.—Habit lacertiform. The distance between the snout and the fore limb is contained once and one-fifth to once and one-third in the distance between the axilla and the groin. Snout long, pointed, much depressed. Lower eyelid scaly. Nasals widely separated, usually divided into a postnasal and a nasal. Frontonasal as long as broad, or slightly broader than long, its anterior border convex and forming a suture with the rostral. Frontonasal frequently forming a suture with the frontal. Frontal large, as long as, or a little longer than the frontoparietals and parietals together, in contact with the first three supraoculars, of which there are four. Supraciliaries numerous, all with the exception of the first two very small. Frontoparietals and interparietal distinct, the latter much smaller than the former. Parietals forming a suture behind the interparietal and bordered by a large temporal and one to three pairs of nuchals. There are five labials anterior to the suboculars. Ear opening small, usually with one or two small anterior lobules. Scales smooth, in 22 to 24 rows round the middle of the body, dorsals largest, especially the two median series. Preanal scales not enlarged. The hind limb reaches the elbow or nearly to the axilla of the adpressed fore limb. Digits slender, with long, sharp claws, the basal phalanges tetragonal, the distal strongly compressed. Subdigital lamellæ smooth, 28 to 35 under the fourth toe. Heel with an enlarged suboval scale. Tail once and one-third to once and one-half the length of the head and body.

Colour.—Uniformly green above and yellowish green below.

Distribution.—The subspecies is restricted to the Solomon Islands.

Section Riopa.

Main Characters.—Lower eyelid scaly, or with a transparent disc. Limbs short or rudimentary. Supranasals present. Ear distinguishable. Prefrontals well developed. Frontal not broader than the supraocular region.

Lygosoma (Riopa) albofasciolata *Günther.*

(Fig. 32.)

Eumeces albofasciolatus Günther, Ann. Mag. Nat. Hist., (4), x, 1872, p. 370.

albofasciolatum Boulenger, Brit. Mus. Cat. Liz., iii, 1887,

Riopa albofasciolata Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 107.

Lygosoma striatofasciatum Ogilby, Rec. Austr. Mus., i, 1890, p. 5.

Main Characters.—Body elongate, stout, the distance between the end of the snout and the fore limb contained once and two-fifths to once and three-fourths in the distance between the axilla and the groin. Snout short, obtusely rounded. Eye nearer to the tip of the snout than to the ear; lower eyelid scaly. Nostril pierced between the nasal and a very small supranasal. Rostral broader than deep. Frontonasal slightly broader than long, forming an equally broad suture with the rostral and frontal. Prefrontals small, but larger than the nasal and supranasal combined. Frontal in contact with the first and second supraoculars, longer than its distance from the end of the snout, as long as its distance from the posterior border of the parietals. Five supraoculars, the fifth very small. Eight supraciliaries, the first largest. Frontoparietals paired, interparietal distinct, as large as or slightly smaller than

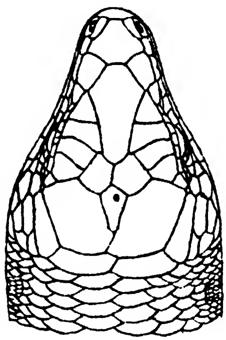

Fig. 32.—*Lygosoma (Riopa) albofasciolata* Boulenger (after Boulenger).

one of the frontoparietals. Parietals forming a short suture behind the interparietal. A pair of nuchals and a pair of temporals border the parietals. Sixth upper labial under the eye, from which it is separated by a row of small scales. Ear opening smaller than the eye opening, with a series of small lobules anteriorly. Scales smooth, in 33 to 36 rows round the centre of the body, the dorsals largest and laterals smallest. Preanals not enlarged. The adpressed limbs fail to meet, or only just touch each other. Digits short, compressed, subdigital lamellæ smooth, 17 to 22 under the fourth toe. Tail longer than the head and body.

Colour.—Dark brown above, with a distinct opaline gloss and more or less distinct, irregular, light cross bands. The labials are dark barred, and there is usually a dark streak from the angle of the mouth to the under part of the shoulder, and another parallel

Dasia smaragdinum perviridis *Barbour.*

Dasia smaragdinum perviridis Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 106.

Main Characters.—Habit lacertiform. The distance between the snout and the fore limb is contained once and one-fifth to once and one-third in the distance between the axilla and the groin. Snout long, pointed, much depressed. Lower eyelid scaly. Nasals widely separated, usually divided into a postnasal and a nasal. Frontonasal as long as broad, or slightly broader than long, its anterior border convex and forming a suture with the rostral. Frontonasal frequently forming a suture with the frontal. Frontal large, as long as, or a little longer than the frontoparietals and parietals together, in contact with the first three supraoculars, of which there are four. Supraciliaries numerous, all with the exception of the first two very small. Frontoparietals and interparietal distinct, the latter much smaller than the former. Parietals forming a suture behind the interparietal and bordered by a large temporal and one to three pairs of nuchals. There are five labials anterior to the suboculars. Ear opening small, usually with one or two small anterior lobules. Scales smooth, in 22 to 24 rows round the middle of the body, dorsals largest, especially the two median series. Preanal scales not enlarged. The hind limb reaches the elbow or nearly to the axilla of the adpressed fore limb. Digits slender, with long, sharp claws, the basal phalanges tetragonal, the distal strongly compressed. Subdigital lamellæ smooth, 28 to 35 under the fourth toe. Heel with an enlarged suboval scale. Tail once and one-third to once and one-half the length of the head and body.

Colour.—Uniformly green above and yellowish green below.

Distribution.—The subspecies is restricted to the Solomon Islands.

Section Riopa.

Main Characters.—Lower eyelid scaly, or with a transparent disc. Limbs short or rudimentary. Supranasals present. Ear distinguishable. Prefrontals well developed. Frontal not broader than the supraocular region.

Lygosoma (Riopa) albofasciolata *Günther.*

(Fig. 32.)

Eumeces albofasciolatus Günther, Ann. Mag. Nat. Hist., (4), x, 1872, p. 370.

Lygosoma albofasciolatum Boulenger, Brit. Mus. Cat. Liz., iii, 1887, p. 302, Pl. xxiv.

Riopa albofasciolata Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 107.

Lygosoma striatofasciatum Ogilby, Rec. Austr. Mus., i, 1890, p. 5.

Main Characters.—Body elongate, stout, the distance between the end of the snout and the fore limb contained once and two-fifths to once and three-fourths in the distance between the axilla and the groin. Snout short, obtusely rounded. Eye nearer to the tip of the snout than to the ear; lower eyelid scaly. Nostril pierced between the nasal and a very small supranasal. Rostral broader than deep. Frontonasal slightly broader than long, forming an equally broad suture with the rostral and frontal. Prefrontals small, but larger than the nasal and supranasal combined. Frontal in contact with the first and second supraoculars, longer than its distance from the end of the snout, as long as its distance from the posterior border of the parietals. Five supraoculars, the fifth very small. Eight supraciliaries, the first largest. Frontoparietals paired, interparietal distinct, as large as or slightly smaller than

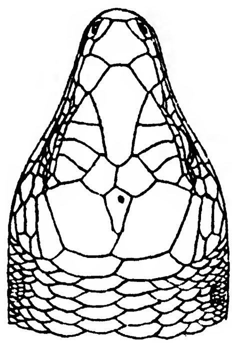

Fig. 32.—*Lygosoma* (*Riopa*) *albofasciolata* Boulenger (after Boulenger).

one of the frontoparietals. Parietals forming a short suture behind the interparietal. A pair of nuchals and a pair of temporals border the parietals. Sixth upper labial under the eye, from which it is separated by a row of small scales. Ear opening smaller than the eye opening, with a series of small lobules anteriorly. Scales smooth, in 33 to 36 rows round the centre of the body, the dorsals largest and laterals smallest. Preanals not enlarged. The adpressed limbs fail to meet, or only just touch each other. Digits short, compressed, subdigital lamellæ smooth, 17 to 22 under the fourth toe. Tail longer than the head and body.

Colour.—Dark brown above, with a distinct opaline gloss and more or less distinct, irregular, light cross bands. The labials are dark barred, and there is usually a dark streak from the angle of the mouth to the under part of the shoulder, and another parallel

with it and further forward on the throat. The lateral edges of the scales are dark, and in some specimens tend to form longitudinal lines.

Distribution.—The range of this species is from north Australia to New Ireland and the Solomon group. The specimens in the Museum collection are from Ysabel, Uji, and St. Anna Islands in the Solomon group.

Affinities.—I have examined Ogilby's type of *Lygosoma striatofasciatum* and seven other specimens ranging in size from 3,010 mm. to 4,130 mm. in total length; the head and body from 1,600 mm. to 1,900 mm., and the tail from 1,500 mm. to 2,500 mm.

Throughout the series, including Ogilby's type, there is no great variation from the description and figure of Boulenger's *Riopa albofasciolatum.* The differences enumerated by Ogilby are not quite as he supposed; for instance he must have bent his specimen to make the limbs overlap, while the other characters given by him I have found to be variable, and there are intermediate forms, proving beyond doubt that his species is synonymous with Günther's *albofasciolata.*

Section EMOA.

Main Characters.—Limbs well developed, pentadactyle, overlapping when pressed against the body. Lower eyelid with an undivided transparent disc. Tympanum distinct. Supranasals present. Rostral forming a suture with the frontonasal. Frontal not broader than the supraocular region. Preanals not or scarcely enlarged.

Key to the species.

A. Less than 34 rows of scales round the body.

B. No interparietal shield; 26 to 32 rows of scales; 40 to 60 lamellæ under the fourth toe .... *cyanurum*

BB. Interparietal shield present; 24 to 26 rows of scales; 70 to 90 lamellæ under the fourth toe .... *cyanogaster*

AA. More than 34 rows of scales round the body.

36 to 40 rows of scales; 32 to 40 lamellæ under the fourth toe .. *nigrum*

LYGOSOMA (EMOA) CYANURUM *Lesson.*

(Fig. 33.)

Scincus cyanurus Lesson, Voy. "Coquille," Zool., ii, p. 49, Pl. iv, fig. 2.

Lygosoma cyanurum Boulenger, Brit. Mus. Cat. Liz., iii, 1887, p. 290. *Id.* Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 103.

Main Characters.—Habit lacertiform. The distance between the end of the snout and the fore limb is contained once to once and one-third the distance between the axilla and the groin. Lower

eyelid with a transparent disc. Nostril situated between a nasal, postnasal, and a supranasal; both of the latter are broader than long. Postnasal much smaller than the frontonasal, the latter forming a suture with the frontal, which is longer than broad and shorter than the frontoparietal. Frontoparietal and the interparietal fused into a single large shield. Parietals broader than long, the centre suture usually shorter than the frontonasal. Four supraoculars, the first two forming a suture with the frontal. Seven or eight supraciliaries. A pair of nuchals and a pair of temporals border the parietals. Seven upper labials, the fifth large and situated under the eye. Ear opening oval, about as large as or a little larger than the transparent palpebral disc; with one to three small, obtuse, anterior lobules. There are from 26 to 32 smooth scales round the body, of which the dorsals are the largest and the laterals smallest. Preanal scales hardly enlarged. The hind limb when stretched forward reaches to about the elbow. Digits somewhat depressed, elongate, with 40 to 60 lamellæ under the fourth toe.

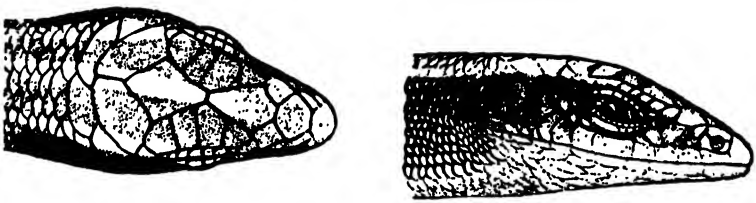

Fig. 33.—*Lygosoma (Emoa) cyanurum* Lesson (after de Rooij).

Colour.—Brownish olive to blackish above, with from three to five longitudinal golden lines. Three of these lines start from the snout, one extends down the centre of the head and back, and the other two one on each side of the head, over the eye, and down the dorso-lateral region.

Distribution.—This species has a very wide range, and extends from the Moluccas through Papuasia, Polynesia, and Australia.

Twenty-five specimens were examined from the Solomon Islands, fourteen of which were collected by Mr. N. S. Heffernan at Cape Marsh, Karamula Island, and on Ysabel Island.

LYGOSOMA (EMOA) CYANOGASTER *Lesson.*

Scincus cyanogaster Lesson, Voy. "Coquille," Zool., ii, p. 47, Pl. iii, fig. 3.

Lygosoma cyanogaster Boulenger, Brit. Mus. Cat. Liz., iii, 1887, p. 292.

Emoa cyanogaster Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 102.

Main Characters.—Snout long, depressed, the distance from the eye to the snout being equal to the distance from the eye to the ear. Lower eyelid with an undivided transparent disc. Nostril pierced between the nasal, supranasal, and a postnasal. Rostral much broader than long, forming a suture with the frontonasal, which is usually broader than long. Frontal longer than broad, narrowly in contact with, or, most generally, separated from the frontonasal by the large prefrontals. Frontoparietal about as broad as long. Interparietal distinct, not much longer than the supranasal. Parietals broader than long, bordered by a pair of nuchals and a pair of temporals. Four supraoculars, the first two in contact with the frontal. Eight upper labials, the sixth band-like and entering the orbit. Mental small, followed by a very large chin-shield, and three or four large shields border the lower labials on each side. Preanals not, or only slightly enlarged. Scales in 24 to 26 rows round the middle of the body, the dorsals largest and laterals smallest. Digits long, somewhat flattened except at the distal end, which is compressed. There are from 70 to 90 small smooth lamellæ under the fourth toe, the last few becoming more or less enlarged. The hind limb when stretched forward reaches to about the shoulder. Tail about twice as long as the head and body.

Colour.—From brownish to olive green above, with small dark and light spots. There may be a broad dark lateral band from the nostril through the eye, becoming broken and diffused on the sides. This band is usually bordered by a series of light spots.

Distribution.—The species has a wide range from the Moluccas through Papuasia, New Ireland, New Hebrides, and the Solomons.

Specimens in the Museum collection, many of which were collected by Mr. Heffernan, come from Tunabuli Harbour, Ysabel Island; Uji Island; South-East Cape, Papua; Murray Island, Torres Strait; Paneiti, Louisiade Archipelago; Hawaiian Islands; New Hebrides.

LYGOSOMA (EMOA) NIGRUM *Hombron and Jacquinot.*

(Fig. 34.)

Eumeces niger Hombron and Jacquinot, Voy. au Pole Sud, iii. 1853, p. 11, Pl. iv, fig. 2.

Lygosoma nigrum Boulenger, Brit. Mus. Cat. Liz., 1887, p. 297.

Emoa nigrum Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 103.

Main Characters.—Habit lacertiform. The distance between the end of the snout and the fore limb may be contained once and one-quarter to once and one-half in the distance between the axilla and the groin. Snout obtuse, long, narrow, its length being equal to the distance between the posterior border of the eye and the posterior border of the ear. Lower eyelid with a transparent disc.

Rostral broader than deep. The nostril pierced between the pre-, post-, and supranasal. Frontonasal slightly broader than long, about as large as the frontoparietal. Prefrontals small, separated by the suture formed by the frontal and the frontonasal. Frontal narrow, longer than its distance from the snout, in contact with the first and second supraoculars, of which there are four, the second being the largest. Frontoparietal single. Interparietal, which is usually present, very small. Parietals not much larger than the frontoparietal, bordered by a pair of temporals and a pair of nuchals. The fifth, sixth, or seventh upper labial below the eye. Ear opening oval, larger than the transparent palpebral disc. Scales in 36 to 40 rows round the middle of the body, dorsals largest, laterals smallest. Preanals slightly enlarged. Digits elongate, compressed, with 30 to 40 lamellæ under the fourth toe. Hind limb when stretched forward reaches to about the shoulder.

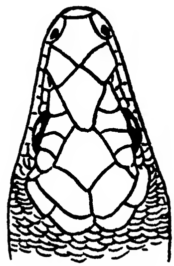

Fig. 34.—*Lygosoma (Emoa) nigrum* (Hombron and Jacquinot).

Colour.—Light to dark brown or almost black above, and greenish yellow to cream below; the under parts of the limbs and throat usually darkly mottled. In the lighter coloured specimens there are usually white spots on the dorso-lateral region from above the ear to about half way along the tail. The sides are blotched with very dark markings, while the dark mottlings on the back may form irregular cross bands. In the dark brown or black varieties the mottlings merge into the ground colour and become indistinct. The top of the head is generally somewhat lighter in shade than the back.

Distribution.—The specimens examined came from Ysabel Island, Furore, S.W. Ysabel Island, Gaudalcanar, all in the Solomon group; one from Samoa. The species has also been recorded from the Carolines; Banks Island; Fiji; New Ireland.

Section LIOLEPISMA.

Main Characters.—Lower eyelid with a transparent disc. Limbs well developed, pentadactyle; the length of the hind limb exceeds the distance between the centre of the eye and the fore

limb. Tympanum distinct. No supranasals, rostral forming a suture with the frontonasal. Nuchals enlarged. Frontal not broader than the supraocular region.

Key to the species.

38 rows of scales round body, 5 supraoculars, ear small .... *anolis*
26 rows of scales round body, 4 supraoculars, ear large .... *noctua*

LYGOSOMA (LIOLEPISMA) ANOLIS *Boulenger.*

(Pl. xiii, fig. 3, and Fig. 35.)

Lipinia anolis Boulenger, Ann. Mag. Nat. Hist., (5), xii, 883, p. 161. *Id.* Boulenger, Trans. Zool. Soc. Lond., xii, 1886, p. 40 Pl. vii, fig. 2.

Lygosoma anolis Boulenger, Brit. Mus. Cat. Liz., iii, 1887, p. 253.

Liolepisma anolis Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 104.

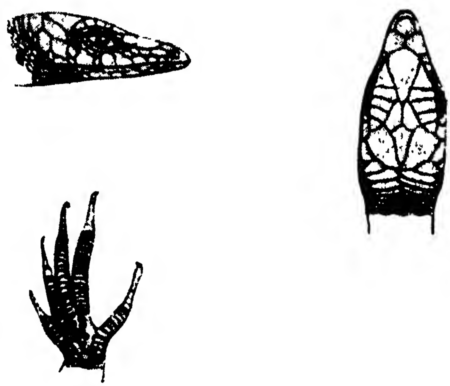

Fig. 35.—*Lygosoma* (*Liolepisma*) *anolis* Boulenger (after Boulenger).

Main Characters.—Habit lacertiform, slender. The distance between the end of the snout and the fore limb is contained once and one-fourth to once and one-third in the distance between the axilla and the groin. Snout long and pointed, much depressed. Lower eyelid with an undivided transparent disc. Nostril pierced in the middle of the nasal. No supranasal, anterior loreal as deep as the nasal. Frontonasal about as broad as long, forming a broad, straight, or slightly curved suture with the rostral. Prefrontals forming a median suture. Frontal kite-shaped, shorter than the frontoparietals and the interparietal together, in contact with two or three anterior supraoculars. Five or six supraoculars, the anterior the largest. Eight to ten supraciliaries, first large. Frontoparietals distinct, about as large as the interparietal. Parietals forming a suture behind the interparietals. Four or five pairs of nuchals. Eight or nine upper labials, the sixth or seventh entering

the orbit. Ear opening small, elliptical, oblique, with four small, round, projecting scales on its anterior border. Scales in 38 rows round the middle of the body, perfectly smooth, laterals smallest, those of the two vertebral series twice as broad as long. Two enlarged preanals. The hind limb reaches to about the level of the elbow. Digits moderately elongated, the basal portion strongly depressed, distinctly dilated, the distal slender and compressed; fourth toe a little longer than the third. Subdigital lamellæ smooth, 16 to 18 under the dilated and 7 under the compressed portion of the toe. Tail a little longer than the head and body.

Colour.—Upper surfaces uniform pale olive or pinkish brown, the head frequently darker and more olive. Limbs sometimes pinkish. Lower surfaces whitish.

Barbour describes this species as "a most curious pallid wraith-like scinc, one of the very characteristic species of the Solomons."

Distribution.—As far as is known the species is confined to the Solomon Islands, and has been recorded from Santa Anna Island; Treasury Island; Shortland Island; Graciosa Bay, Santa Cruz; Uji Island; Malaita; and Wainone Bay, San Cristoval.

LYGOSOMA (LIOLEPISMA) NOCTUA *Lesson.*

Scincus noctua Lesson, Voy. "Coquille," Zool., ii, 1830, p. 48, Pl. iii, fig. 4.

Lygosoma noctua Boulenger, Brit. Mus. Cat. Liz., 1887, iii, p. 256.

Liolepisma noctua Barbour, Proc. New Eng. Zool. Club, vii, 1921, p. 104.

Main Characters.—Habit lacertiform. The distance from the tip of the snout to the fore limb is equal to once and one-quarter to once and three-quarters the distance between the axilla and the groin. Snout narrow, shorter than the distance from the posterior border of the eye to the ear. Lower eyelid with an undivided transparent disc. Nostril pierced in the nasal. Rostral broader than deep, forming a suture with the frontonasal, which is usually broader than long, and may or may not form a narrow suture with the frontal. Prefrontals small, not as large as the interparietal. Frontal narrow, longer than its distance from the snout and a little shorter than the frontoparietal and interparietal together; in contact with the first and second supraoculars, of which there are four. Interparietal distinct. Frontoparietal single or divided. Parietals large, forming a suture behind the interparietal, and bordered by two or three pairs of nuchals. Seven upper labials, the fifth under the eye. Ear opening without projecting lobules; smaller than the eye opening. Scales in 26 to 28 rows round the middle of the body, all smooth, dorsals the largest, laterals smallest. Preanal scales enlarged. The adpressed limbs overlap. Digits depressed at the base, compressed at the tips. Subdigital lamellæ

smooth, in 19 to 22 rows under the fourth toe. Tail longer than the head and body.

Colour.—Light to golden brown above, a whitish brown-edged spot on the nape usually very distinct. Continuous with this spot is a light vertebral stripe bordered by a diffused brown line of irregular spots, or a dark line with white spots. Under surface of body usually white, though in the smaller specimens there may be many small dark spots. Tail usually spotted on the under surface.

The series ranges in length from 62 mm. to 110 mm.

Comparative.—I have examined a series of fifty specimens in the Museum collection, thirty-seven of which are from Kiriwini, Trobriand Islands.

It is worthy of note that the frontoparietal may be either single or divided; in either case the shape of the extreme outline is the same, the only difference being a median suture. This is the only character by which some of my specimens differ from the original description, and I cannot consider it varietal. Three specimens from the Solomons, several from Raratonga and Fiji have the divided shield, while in the remainder it is single.

The remaining characters and colour of the entire series agree in detail with Boulenger's description.

Distribution.—The species has already been recorded from Fiji, Papua, New Hebrides, Friendly Islands, Hawaiian Islands, Tongatabu, Samoa, and the Solomons. Although it has till now been considered a rarity, I have, as stated above, thirty-seven specimens from Kiriwini, Trobriand Islands, collected by the Rev. S. B. Fellows in 1897. Two of the most interesting records before me are: one specimen, Flint Island, south of Tahiti, collected in 1900 by C. J. Merfield; and one fróm Funafuti, collected in 1904 by Professor Sir T. W. Edgeworth David.

CROCODILIA.

Genus CROCODILUS.

CROCODILUS POROSUS *Schneider.*

Crocodilus porosus Schneider, Hist. Amph., ii, 1801, p. 159. *Id.* Boulenger, Brit. Mus. Cat. Chel. and Croc., 1889, p. 284.

Main Characters.—This species has a very extensive distribution from India to China, through the Malay Peninsula and Archipelago to north Australia and the Solomon Islands. It is on record that, on one occasion only, a specimen was found, after very heavy weather, to have strayed as far as the Fiji Islands.

Among the specimens in the collection are six young ones, measuring from twelve to sixteen inches in length, and a number of eggs.

Mr. Heffernan informs me that frequently on moonlight nights, he has observed crocodiles digging up with their forepaws, and eating, the Sand Crab (*Ocypoda* sp.), which lives in its burrow at a depth of about twelve inches in the soft sand.

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EXPLANATION OF PLATE XIII.

Fig. 1. *Dasia smaragdinum* Lesson (after Barbour).

Fig. 2. *Lepidodactylus woodfordi* Boulenger (after Boulenger).

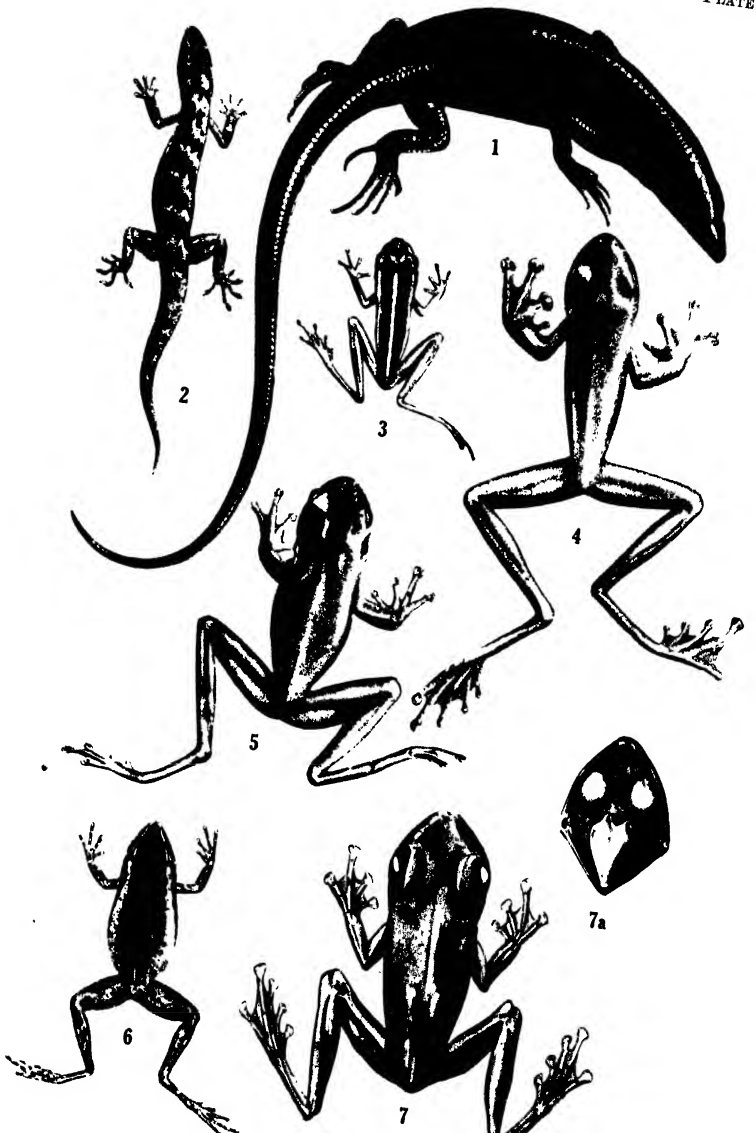
Fig. 3. *Hyla thesaurensis* Peters (after Boulenger).

Fig. 4. *Hyla lutea* Boulenger (after Boulenger).

Fig. 5. *Hyla macrops* Boulenger (after Boulenger).

Fig. 6. *Batrachylodes vertebralis* Boulenger (after Boulenger).

Fig. 7. *Hypsirana heffernani,* gen. et sp. nov.



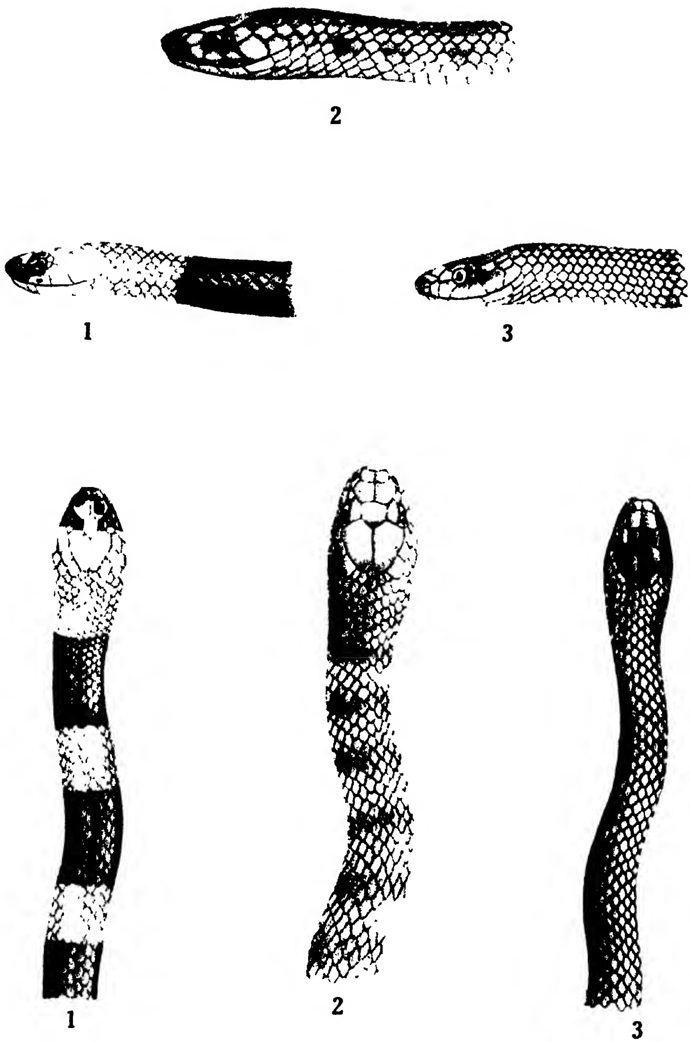
G. C. CLUTTON Photo. (Figs. 1-6).
J. R. KINGHORN, del. (Figs. 7 and 7a).

EXPLANATION OF PLATE XIV.

Fig. 1. *Micropechis elapoides* Boulenger (after Boulenger).

Fig. 2. *Denisonia par* Boulenger (after Boulenger).

Fig. 3. *Denisonia woodfordi* Boulenger (after Boulenger).



G. C. CLUTTON Photo.

EXPLANATION OF PLATE XV.

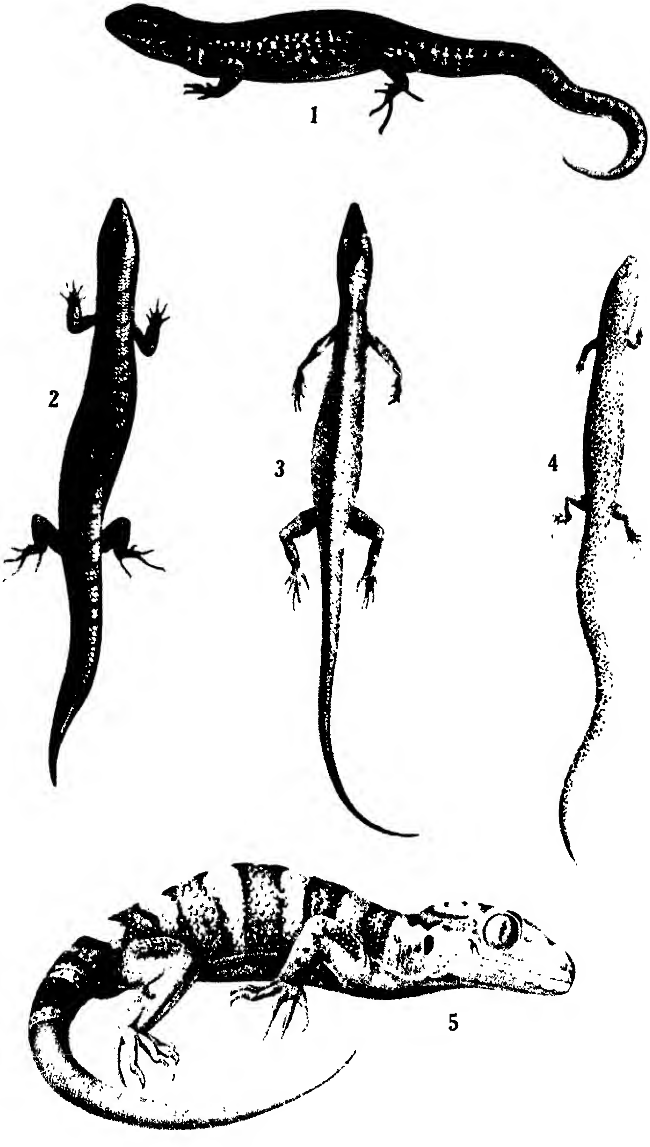
Fig. 1. *Lygosoma Hinulia concinnatum* Boulenger (after Boulenger).

Fig. 2. *Lygosoma Hinulia woodfordi* Boulenger(after Boulenger).

Fig. 3. *Lygosoma Liolepisma anolis* Boulenger (after Boulenger).

Fig. 4. *Lygosoma Hinulia solomonis* Boulenger (after Boulenger).

Fig. 5. *Gymnodactylus louisiadensis* De Vis (after Garman).



G. C. CLUTTON Photo.

THE FRESH-WATER EELS OF AUSTRALIA.

With Some Remarks on the Short-finned Species of *Anguilla*.

By

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(Figures 1-14.)

I. INTRODUCTION.

In the course of my work in describing the fresh-water eels of the genus *Anguilla* throughout the world, I have now come to those of Australia. Prior to this were the descriptions of the eels of Europe, America and Japan (1913, 1915), of the eels in the tropical part of the Southern Pacific (1927) and of the eels of New Zealand.[1, 2, 3, 4] In all of these works I have emphasized the value, or more properly the necessity, of employing numerical characters such as the number of vertebræ and of fin-rays for the classification of the different species of the genus *Anguilla*, which are often very closely related. It is only since the introduction of modern variational-statistic methods that complete certainty has been attained in the classification of the fresh-water eels; and the use of such numerical characters as the number of vertebræ has further rendered it possible to distinguish between the species in their very youngest stages, even when, as tiny, transparent larvæ, they are found floating out in the ocean, far from land.

Most of the more important museums throughout the world have, with the greatest liberality, accorded the Carlsberg Laboratory facilities for investigating their material of the genus *Anguilla*, and taking X-ray photographs of the same. We were thus enabled to include in our investigations all existing types, as well as many other specimens of fresh-water eels mentioned in earlier and recent

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[1] Johs. Schmidt.—"First and Second Report on Eel Investigations" (Rapports et Procès-Verbaux du Conseil International pour l'Exploration de la Mer, Vols. XVIII and XXIII, Copenhagen, 1913 and 1915).

[2] *Id.*—"Les Anguilles de Tahiti" (La Nature, Paris, 15 July, 1927, reprint paged 1-8).

[3] *Id.*—"The Fresh-Water Eels of New Zealand" (Transactions of the New Zealand Institute, Wellington, N.Z., Vol. lviii, No. 4 (in the press).

[4] *Id.*—"The Breeding Places of the Eel" (Smithsonian Report for 1924 (1925), p. 279. This includes a survey of the results of my cruises in the Atlantic in order to ascertain the breeding places of the eel and the migrations of the eel-larvæ.

literature, a point which has proved of importance, *inter alia,* for the nomenclature.

Recently (1925) I described the distribution of the eels in the Indo-Pacific region, in a work entitled: "On the Distribution of the Fresh-water Eels (*Anguilla*) throughout the World, II. Indo-Pacific Region."[5] The most important literature on the subject is there noted, and it will here suffice to refer to that work. My task at that time was mainly to describe the distribution of the fresh-water eels in general; the present work, however, is designed to give a closer analytical survey of the *species* and their distribution.

It is my very pleasant duty here to express my appreciation of the readiness with which the fishery authorities of Australia, and the Australian Museum at Sydney, endeavoured to facilitate my task. The last-named institution, for instance, forwarded its entire collection of *Anguilla* to the Carlsberg Laboratory for investigation. The fishery authorities in New South Wales (State Fisheries, Mr. A. W. Wood, Officer-in-Charge), in Victoria (Mr. F. Lewis, Chief Inspector) and in Western Australia (Mr. F. Aldrich, Chief Inspector) have procured for me more or less extensive samples of Australian fresh-water eels, in the forwarding of which valuable assistance was kindly rendered by the Royal Danish Consuls at Sydney (Mr. C. W. Koefoed), Melbourne (Mr. P. Holdensen) and Perth (Mr. P. H. Fraenkel). Collections of fresh-water eels were also made at Lord Howe Island by Mr. R. E. Baxter.

I am indebted to a number of Australian zoologists, who have kindly helped me with information or material, thus to Dr. C. Anderson, the Australian Museum, Sydney, the late Allan R. McCulloch, the Australian Museum, Sydney, Mr. J. A. Kershaw, the National Museum, Melbourne, Mr. Heber A. Longman, Queensland Museum, Brisbane, Mr. T. C. Roughley, the Technological Museum, Sydney, the late Edgar R. Waite, the South Australian Museum, Adelaide, and Mr. Gilbert P. Whitley, the Australian Museum, Sydney.

Finally, I wish to express my hearty thanks to those who have collaborated with me in the work of investigation at the Carlsberg Laboratory, especially Mr. Vilh. Ege, M.Sc., and Miss E. Hansen.

II. CLASSIFICATION.

Examination of the collections received from Australia, and of the Australian material I have found in the various museums, shows

[5] Schmidt.—Mem. Acad. Roy. Sci. et Lettres de Danemark (8), X, 4, Copenhagen, 1925, pp. 329-382, pls. i-ii and 10 text-figs.

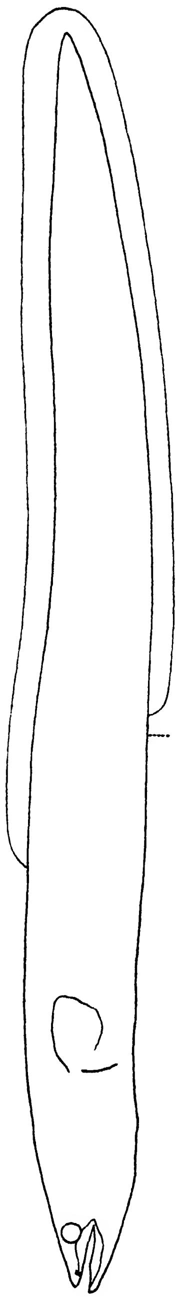

Fig. 1.—*Anguilla reinhardti* Steind., the long-finned or spotted eel. Semi-schematic drawing from a specimen 47 cm. in length, by Mr. Vilh. Ege, M.Sc.

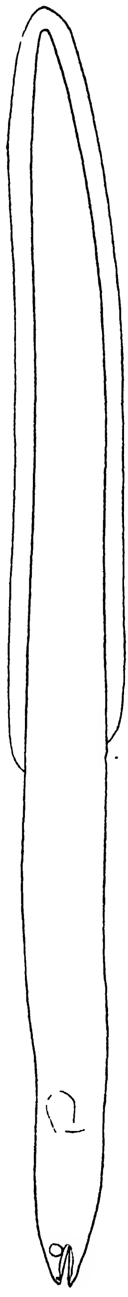

Fig. 2.—*Anguilla australis* Rich. f. *occidentalis* n.f., the short-finned or unspotted eel. Semi-schematic drawing from a specimen 42 cm. in length, by Mr. Vilh. Ege, M.Sc.

that there are *four* species of *Anguilla* to be met with on the continent of Australia, and that they should be named as follows:

Anguilla australis Richardson
Anguilla reinhardti Steindachner
Anguilla obscura Günther
Anguilla bicolor McClelland.

The last-named species is an Indian form, occurring in the north-western tropical part of Australia; the other three are all Pacific forms. Of these, *Anguilla obscura* is represented only by a single specimen from the tropical part of Queensland (Burdekin River, north of Bowen); for the rest, its area of distribution comprises the tropical part of the Pacific south of the Equator, where it has been taken as far east as Tahiti.

There remain then, *Anguilla australis* Rich. and *Anguilla reinhardti* Steind. A fresh-water eel caught in any part of Australia south of the tropical belt will in nearly every case be found to belong to one or other of these two species, which are extremely common. Fortunately, there are good distinguishing characters, rendering it a matter of no great difficulty to determine which is which. I suggest that the most conspicuous of these distinguishing characters should be embodied in the English names, so that we have the *long-finned* or *spotted* eel (*Anguilla reinhardti*) and the *short-finned* or *unspotted* eel (*Anguilla australis*). The names long-finned and short-finned have already been employed by other writers.

Generally speaking, the two species are recognizable one from the other at a first glance by their colouring: save in the youngest specimens, *Anguilla reinhardti* is speckled all over with roundish spots, which are *invariably* lacking in *Anguilla australis*. It has been noted, however, that *Anguilla reinhardti*, when approaching maturity, or, to use the term employed in Europe, becoming a "silver eel," and preparing for its migration to the sea, loses its spots more or less completely. This was the case, for instance, with a large sample of eels about a metre long, caught at Prospect Reservoir spillway near Sydney on the 25th June, 1925, and kindly placed at my disposal by the courtesy of the State Fisheries and the Australian Museum at Sydney. This sample consisted almost exclusively of large, "silvery" female specimens of *Anguilla reinhardti*, and the spots had almost entirely disappeared, save for a few cases where some spots remained on the head.

The spotted colouring of *Anguilla reinhardti*, though ordinarily by far the most conspicuous mark of distinction from *Anguilla australis*, which is never spotted, may thus be lacking, firstly in the youngest specimens, and again in the oldest ones. It will therefore be necessary to note the other distinguishing features, or at any rate, the most important ones.

Among these we have first and foremost $(a-d)$, or the distance between the vent and the front of the dorsal fin. The difference between the two species will be at once apparent on comparing Fig. 1 (*Anguilla reinhardti*) and Fig. 2 (*Anguilla australis*). In the former, the dorsal fin extends a long way forward beyond the vent, whereas in *Anguilla australis* the corresponding distance is but short. This character $(a-d)$ is of great value in the classification of the genus *Anguilla*. Our method is to determine it in every single specimen, and express it as a percentage of the total length: $\frac{a-d}{t} \times 100$ or $(a-d)$ percentage.

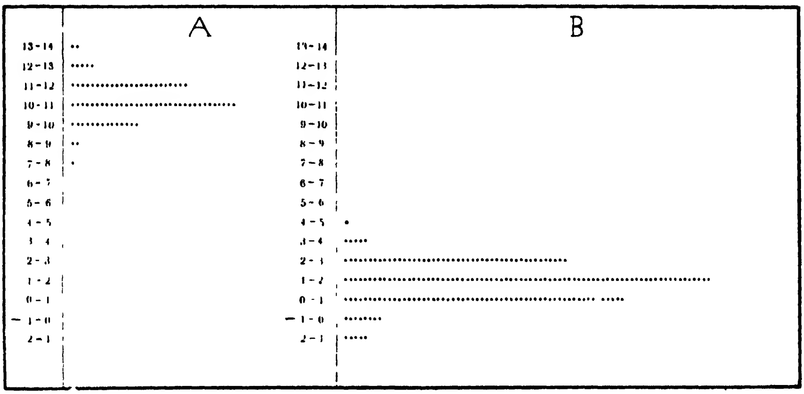

Fig. 3.—$\frac{a-d}{t} \times 100$ in 84 specimens of the long-finned eel (*Anguilla reinhardti* Steind.) from Prospect Reservoir, near Sydney (*A*) and 198 specimens of the short-finned eel (*Anguilla australis* Rich. f. *occidentalis* n.f.) from Victoria (*B*); averages: 10·72% (*Ang. reinhardti*) and 1·27% (*Ang. australis* f. *occidentalis* n.f.).—Each dot denotes a specimen.

Fig. 3 shows, in the form of a graph, $\frac{a-d}{t} \times 100$ for two samples, one of the long-finned eel (*Anguilla reinhardti*) and one of the short-finned eel (*Anguilla australis*), the former from New South Wales (neighbourhood of Sydney), the latter from Victoria. Each dot represents one specimen. In the 84 specimens of *Anguilla reinhardti*, the values varied between 7·8% and 13·2%, with an average of 10·72%; the values for the 198 specimens of *Anguilla australis* range from $-1·5\%$ to $+4·0\%$, with an average of 1·27%. The highest value noted for the short-finned eel was thus 4·0%, and the lowest for the long-finned 7·8%.[6]

[6] The value is 0 when the dorsal fin begins immediately above the vent, and negative when the point of commencement lies behind the vent.

Despite the considerable number of specimens, there was no overlapping between the two species, as will at once be evident on glancing at the graph, Fig. 3. The schematic arrangement in Fig. 4 shows the same thing; here, we have the variation of $\frac{a-d}{t} \times 100$ for the two species drawn in one and the same figure.

The examination of these two samples of the two Australian species, together with many others investigated at the Carlsberg Laboratory, shows beyond question that $\frac{a-d}{t} \times 100$ is a good distinguishing character. When carefully measured, it will in practically every case suffice for distinction between the short-finned

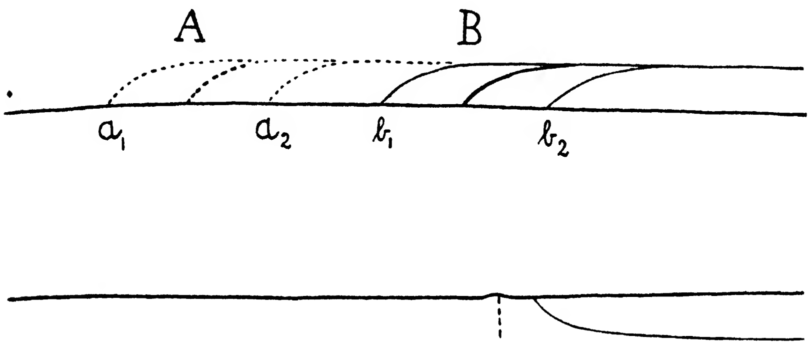

Fig. 4.—$\frac{a-d}{t} \times 100$.—Schematic representation of the variation of this value in the two samples represented graphically in Fig. 3. A and B = average values; a_1 and b_1 = highest, a_2 and b_2 lowest values in long-finned eel (*Anguilla reinhardti*) and short-finned eel (*Anguilla australis* f. *occidentalis* n.f.) respectively.

and the long-finned eel within the States of New South Wales and Victoria. Other useful distinguishing characters are afforded by the number of vertebræ, one in the total number, and another in the number of præhæmal vertebræ.

Fig. 5 shows graphically the total number of vertebræ in a sample of 190 specimens of *Anguilla australis* from New South Wales (near Sydney) and a sample of *Anguilla reinhardti* from the same district. As will be seen, there is but slight overlapping; in *Anguilla australis* the number of vertebræ varied between 109 and 116 with an average of 112·68, in *Anguilla reinhardti* between 104 and 110 with an average of 107·72.

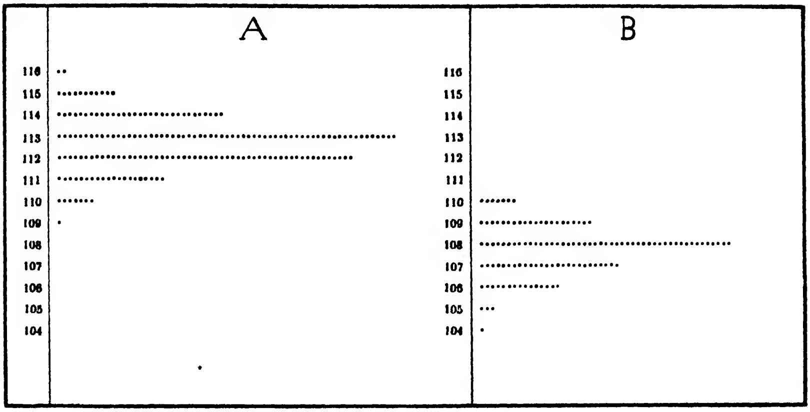

Fig. 5.—Total number of vertebræ in 190 specimens of the short-finned eel (*Anguilla australis* f. *occidentalis* n.f.) from Sydney and Prospect (109) and from Marley Beach, S. of Port Hacking (*A*), and in 120 specimens of the long-finned eel (*Anguilla reinhardti*) from Prospect Reservoir, Sydney (83), and from Marley Beach, S. of Port Hacking (*B*); averages: 112·68 (*Ang. australis* f. *occidentalis* n.f.) and 107·72 (*Ang. reinhardti*).—Each dot denotes a specimen.

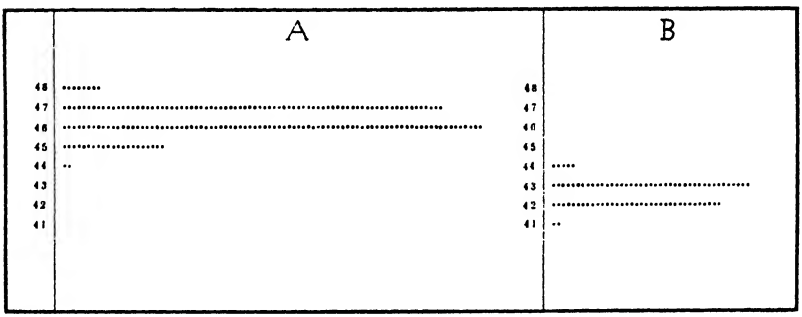

Fig. 6.—Number of præhæmal vertebræ in 195 specimens of the short-finned eel (*Anguilla australis* f. *occidentalis* n.f.) from Victoria (*A*), and in 83 specimens of the long-finned eel (*Anguilla reinhardti*) from Prospect Reservoir, near Sydney (*B*); averages: 46·35 (*Ang. australis* f. *occidentalis* n.f.) and 42·59 (*Ang. reinhardti*).—Each dot denotes a specimen.

The graph in Fig. 6 shows the number of præhæmal vertebræ in a sample of *Anguilla australis* from Victoria and one of *Anguilla reinhardti* from New South Wales. In the former, the number varied between 44 and 48, with an average of 46·35; in the latter, from 41 to 44, with an average of 42·59.

Among other numerical characters I may mention the number of branchiostegal rays and number of pectoral rays.

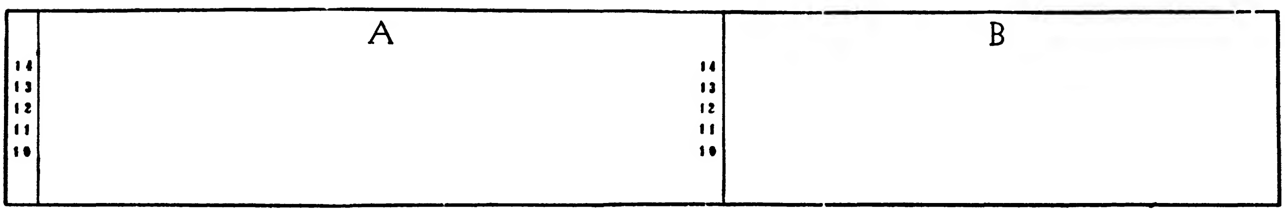

Fig 7.—Number of branchiostegal rays in 198 specimens of the short finned eel (*Anguilla australis f occidentalis* n f) from Victoria (*A*), and in 119 specimens of the long finned eel (*Anguilla reinhardti*) from Prospect Reservoir near Sydney (83) and from Marley Beach, S of Port Hacking (*B*), averages 12 00 (*Ang australis f occidentalis* n f) and 10 96 (*Ang reinhardti*) —Each dot denotes a specimen

Fig. 7 shows graphically the number of branchiostegal rays in samples of *Anguilla australis* (Victoria) and of *Anguilla reinhardti* (New South Wales). It will be seen that the average number is about 1 higher in *Anguilla australis* than in *Anguilla reinhardti* (12·00 as against 10·96).

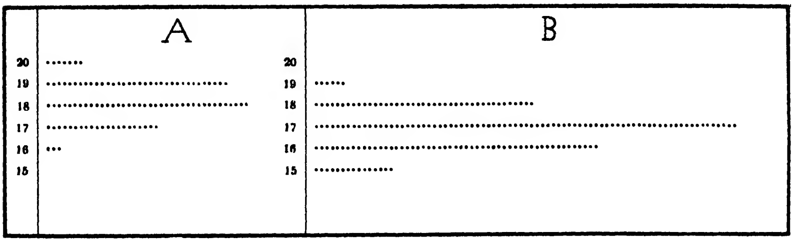

Fig. 8.—Number of pectoral rays in 103 specimens of the long-finned eel (*Anguilla reinhardti*) from Prospect Reservoir, near Sydney (79), and from Marley Beach, S. of Port Hacking (*A*), and in 194 specimens of the short-finned eel (*Anguilla australis* f. *occidentalis* n.f.) from Victoria (*B*); averages: 18·20 (*Ang. reinhardti*) and 16·85 (*Ang. australis* f. *occidentalis* n.f.).—Each dot denotes a specimen.

Fig. 8 represents the number of rays in the right pectoral fin, in the same samples of the two species as those used for Fig. 7. Here, it is *Anguilla reinhardti* which shows the higher average figure, *viz.* 18·20 as against 16·85 for *Anguilla australis.*

Finally, we have the dentition, or form of the teeth-bands, as illustrated in Fig. 9. Like several other spotted species, *Anguilla reinhardti* belongs to a group within the genus *Anguilla* distinguished by having the maxillary and mandibulary teeth-bands longitudinally divided by a groove, the outer strip containing a series of large, the inner a series of minute teeth. This arrangement may be more or less distinct; in *Anguilla reinhardti* it is often less pronounced than in the other species belonging to this group (*Anguilla mauritiana, labiata,* etc.). Figs. 9, *a*, *b*, and *c* show the dentition of the maxillæ in three specimens of *Anguilla reinhardti*, including the type preserved in the Vienna Museum, described by Steindachner (Fig. 9*a*).

The three figures of the dentition in the upper jaw of *Anguilla australis* (Figs. 9*d, e, f*) show that the maxillary teeth-bands are broader in this species than in *Anguilla reinhardti,* that the toothless groove is lacking, and that the vomerine band is shorter, broader and less pointed. Finally, it may be noted that the greatest breadth of the vomerine band lies as a rule behind the middle, whereas the greatest breadth in *Anguilla reinhardti* (and also in *Anguilla bicolor* and *Anguilla obscura,* see Fig. 10) lies farther forward. The

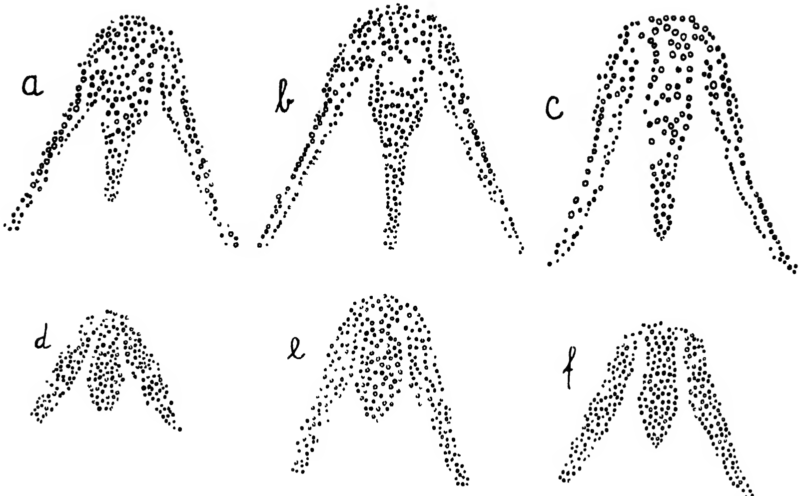

Fig. 9.—Teeth-bands of the upper jaw in 6 eels, 3 of *Anguilla reinhardti*, the long-finned eel (*a*, *b*, *c*) and 3 of *Anguilla australis* f. *occidentalis* n.f., the short-finned eel (*d*, *e*, *f*).

a: *Anguilla reinhardti* Steind., Rockhampton, Queensland, from type in the Natural History Museum of Vienna.

b: *Anguilla reinhardti* Steind., Gayndah, Queensland, from specimen in the Zoological Museum of Hamburg.

c: *Anguilla marginipinnis* Macleay, Lillesmere Lagoons, Burdekin River, Queensland, from co-type (A 18001) in the Australian Museum, Sydney.

d: *Anguilla australis* Rich., Tasmania, from type in the British Museum.

e: *Anguilla australis* Rich., Melbourne, from specimen (I 331) in the Australian Museum, Sydney.

f: *Anguilla australis* Rich., Delegate, N.S.W., from specimen (I 14637) in the Australian Museum, Sydney.

Drawings by Mr. Vilh. Ege, M.Sc.

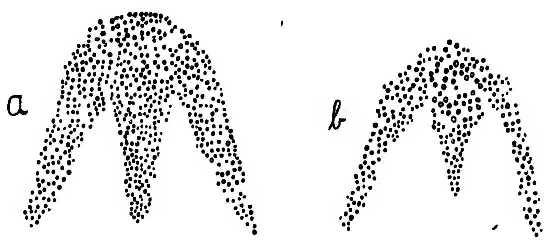

Fig. 10.—Teeth-bands of the upper jaw in *Anguilla bicolor* McClell. (*a*) and *Anguilla obscura* Günther (*b*).

a: *Anguilla australis* Rich. (Rendahl, in Meddelelser Zool. Museum, Kristiania, No. 5, 1922), from specimen collected by Dr. Knut Dahl in Roebuck Bay, Western Australia.

b: *Anguilla marginipinnis* Macleay, Lillesmere Lagoons, Burdekin River, Queensland, from co-type (A 17998) in the Australian Museum, Sydney.

Drawings by Mr. Vilh. Ege, M.Sc.

vomerine band of *Anguilla australis* is therefore often shaped like the tongue or clapper of a bell (see Figs. 9*d, e, f*).

In the preceding, mention has been made of various characters whereby it is possible with the greatest certainty to distinguish between the two species of fresh-water eels found in the States of Victoria and New South Wales: the long-finned or spotted eel (*Anguilla reinhardti*) and the short-finned or unspotted eel (*Anguilla australis*), which, as a matter of fact, are not very closely related. Even without employing such characters as the number of vertebræ, which call for detailed examination of the specimens, it will as a rule be easy to distinguish between the two species. Given a specimen, or specimens, which it is desired to identify, the following characters should be considered:

1. Whether the body is spotted or not, *Anguilla reinhardti* being typically spotted, *Anguilla australis* never spotted.

2. $\frac{a-d}{t} \times 100$ or the $(a-d)$ percentage, being the distance between front of dorsal fin and vent, expressed in percentage of the total length (see Figures 1-2, 3-4).

3. Shape of the teeth-bands (see Fig. 9).

These three characters will unquestionably always suffice to determine with certainty whether a given specimen belongs to the species *Anguilla reinhardti* or *Anguilla australis*.

Up to the present, we have considered only the two species of *Anguilla* found in the States of New South Wales and Victoria: *viz. Anguilla australis* and *Anguilla reinhardti*. At the beginning of this section it was pointed out that there are two other species found in Australia, *viz. Anguilla bicolor* and *Anguilla obscura*, both short-finned, unspotted species, the former being of Indian, the latter of Pacific origin. Both are easily distinguished from *Anguilla australis*, save when dealing with quite small specimens, by the fact that the angle of the mouth extends back a considerable distance beyond the eye, whereas in *Anguilla australis*, this angle lies approximately below the hind margin of the eye, as shown in Fig. 2. The dentition also is as already noted, a useful character for distinguishing these two species from *Anguilla australis*; this will be seen on comparing Fig. 9 and Fig. 10. This last figure further shows the difference between *Anguilla bicolor* and *Anguilla obscura* in the shape of the teeth-bands, while from Figs. 11 and 12 it will be seen that there is great difference also in regard to the number of vertebræ (averages: 109·37 and 103·90 respectively); the character $\frac{a-d}{t} \times 100$ also shows considerable difference between the two.

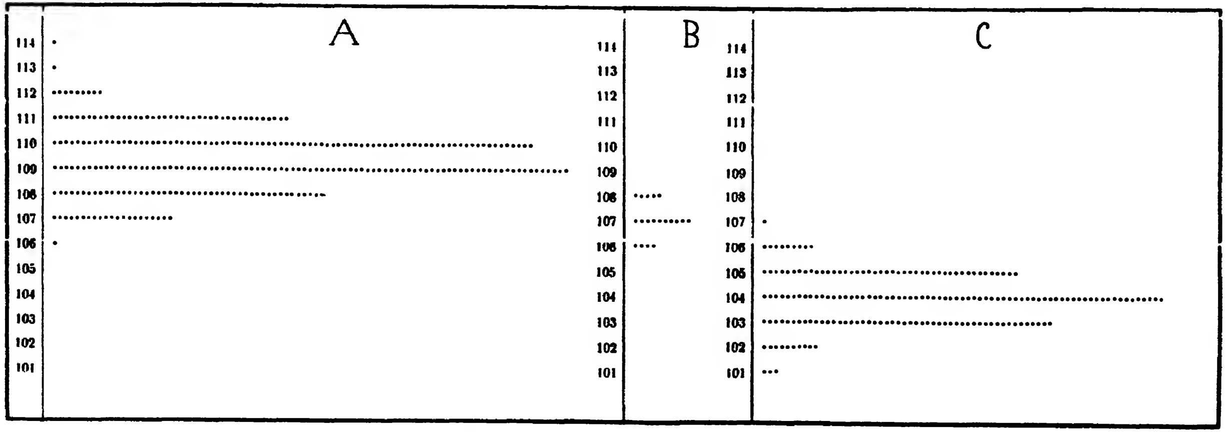

Fig. 11.—Total number of vertebræ in 294 specimens of *Anguilla bicolor* McClell. from Telok Dalem, Nias (*A*), in 19 specimens of *Anguilla pacifica* n.sp. (*B*) and in 188 specimens of *Anguilla obscura* Günther from Tahiti (*C*); averages: 109·37 (*Ang. bicolor*), 107·05 (*Ang. pacifica*) and 103·90 (*Ang. obscura*).—Each dot denotes a specimen.

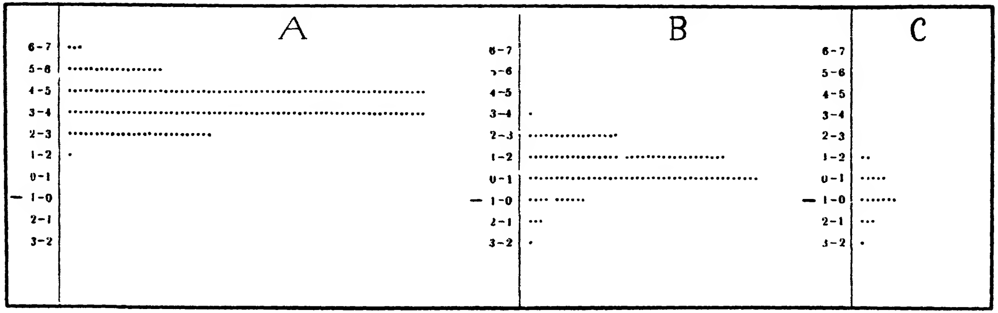

Fig. 12.—$\frac{a \div d}{t} \times 100$ in 183 specimens of *Anguilla obscura* Günther from Tahiti (*A*), in 113 specimens of *Anguilla bicolor* (McClell.) from Tangerang, Java (*B*), and in 19 specimens of *Anguilla pacifica* n.sp. from northern New Guinea, Philippines, *et cetera* (*cf.* Fig. 14) (*C*); averages: 3·91% (*Ang. obscura*), 0·88% (*Ang. bicolor*) and —0·31% (*Ang. pacifica* n. sp.).—Each dot denotes a specimen.

III. DISTRIBUTION.

The present work is based on the investigation of 928 specimens of *Anguilla*. Of these, 747 came from the continent of Australia, 51 from Tasmania, including Flinders and Vansittart Islands, 125 from Lord Howe Island and 5 from Norfolk Island. The distribution is as follows:

Australia: 547 *Anguilla australis*, 190 *Anguilla reinhardti*, 9 *Anguilla bicolor*, 1 *Anguilla obscura*.

Tasmania incl. Flinders and Vansittart Is.: 51 *Anguilla australis*.

Lord Howe Island: 85 *Anguilla australis*, 40 *Anguilla reinhardti*.

Norfolk Island: 5 *Anguilla australis*.

I will now take the different species separately.

1.—Anguilla reinhardti *Steindachner*.

The Long-finned or Spotted Eel.

This species was described in 1867 by Steindachner, from a specimen taken at Rockhampton, Queensland (!). As will be seen from the chart, Fig. 13, it is distributed on the continent of Australia from Cape York (2 samples in the British Museum!) and southward from there along the east coast as far as Port Phillip, Melbourne; I have myself seen a specimen from here, *viz.* the one described by Klunzinger[7] under the name of *Anguilla amboinensis* Peters. Thanks to the courtesy of the Museum at Stuttgart, Germany, where it is preserved, we have been able to examine this specimen. It is a typical *Anguilla reinhardti* with 43 + 66 = 109 vertebræ, and $\frac{a-d}{t} \times 100 = 9{\cdot}2$, values which, as will be seen, are of common occurrence in this species.

Outside the continent of Australia, *Anguilla reinhardti* is found on Lord Howe Island, where it is common; out of 125 specimens of *Anguilla* from here, 40 belonged to this species. It also occurs in New Caledonia; in 1926-27, some hundreds of specimens were sent from there to the Carlsberg Laboratory by Monsieur Jean Risbec, of Noumea. Neither the *Anguilla reinhardti* from Lord Howe Island nor those from New Caledonia are, as far as our investigations go, racially different from those living on the mainland of Australia. As will be seen from Fig. 5, the average number of vertebræ for 120 specimens from Sydney was 107·72, the average for Lord Howe Island (38 specimens) was 107·74 and for Noumea (New Caledonia) 107·82 (62 specimens).

[7] Klunzinger.—Sitzungsber. Akad. Wien, XXX, 1879, p. 419.

Anguilla reinhardti is the fresh-water eel *par excellence* of Queensland, all the specimens of eels hitherto known from that State having been found to belong to this species, with but a single exception (a specimen of *Anguilla obscura*). In New South Wales also it is very common, but has here to share the honours with *Anguilla australis*, which, as far south as the neighbourhood of Sydney, seems to be as numerous as *Anguilla reinhardti*, if not more so. Finally, in the State of Victoria, *Anguilla reinhardti* is far less common than *Anguilla australis*, and in Tasmania it has not yet been observed.

It may here be noted that Steindachner's type (Vienna Museum) was found to have 43 + 66 = 109 vertebræ, with an $(a-d)$ percentage of 9·7. It should further be mentioned that a specimen in the British Museum, brought home by H.M.S. "Challenger" from the Mary River, Queensland (Brit. Mus. 79.5.14.430), determined as *Anguilla mauritiana* by Günther,[8] proved to be a typical *Anguilla reinhardti* (vertebræ: 42 + 65 = 107, and $(a-d)$ percentage = 10·5). *Anguilla mauritiana* must therefore be deleted from the fauna of Australia for the time being.

It would be useful in the work of further research if zoologists or other interested parties in Australia would endeavour to ascertain the length and weight attained by *Anguilla reinhardti*. The sample already noted as from Prospect Reservoir, near Sydney (85 specimens) which, thanks to the courtesy of the State Fisheries Department and the Australian Museum, Sydney, we were enabled to investigate at the Carlsberg Laboratory, consisted exclusively of females, about a metre long. The largest measured 128 cm. (weight 4,950 grammes), the smallest 79 cm. (weight 1,275 grammes); the majority were about 1 metre in length, weight about 2,500 grammes.

From the Chief Inspector of Fisheries and Game, Melbourne, I received, through the Danish Consulate in that city, three large eels preserved in formalin, which proved to belong to *Anguilla reinhardti*. They measured 120·5, 123·5 and 135 cm. in length, and weighed 4,760, 6,160 and 4,910 grammes respectively. According to information from the Chief Inspector, in a letter dated Melbourne 11th June, 1925, "these eels were taken in the eastern part of Victoria in brackish water, but are also commonly obtained in the rivers on that State 100 miles from the nearest salt water. They are locally known as Conger eels. The size of these is, I think, somewhat out of the ordinary, and in no other part of this State are eels of this size caught. . . Specimens of these eels have been taken up to as much as 30 lbs. in weight."

During my stay in Australia, in January and February, 1926, I received several letters containing information as to eels in Australia, and was greatly interested in the data supplied. I would here mention a letter from Mr. N. Johnson, dated from Mossiface, East Gippsland, Victoria, 27th January, 1926, who writes: "If you

[8] Günther.—"Challenger" Report, Zoology, i, Shore Fishes, 1880, p. 33.

like to come up to Tambo River, I will show you eels up to twenty lbs. weight. I live right alongside the river bank. I have seen them pulling my ducks under the water. You can catch them at the Mossiface wharf in the evening."

It will be apparent from the above that I have not personally seen any specimen of *Anguilla reinhardti* over 135 cm. in length and 6·7 kilograms in weight. It is most likely, however, that the larger eels, of 20 or 30 lbs., noted above belong to this species rather than to *Anguilla australis*. In any case, it is remarkable that eels of this size should be specially noted as occurring only in the eastern part of the State of Victoria, for *Anguilla australis* is, as we have seen, extremely common also in the western part. This view is supported by the chart, Fig. 13, showing the difference between the respective distributions of the two species.

There remains then, the question, What length and weight are attained by the long-finned or spotted eel (*Anguilla reinhardti*)?

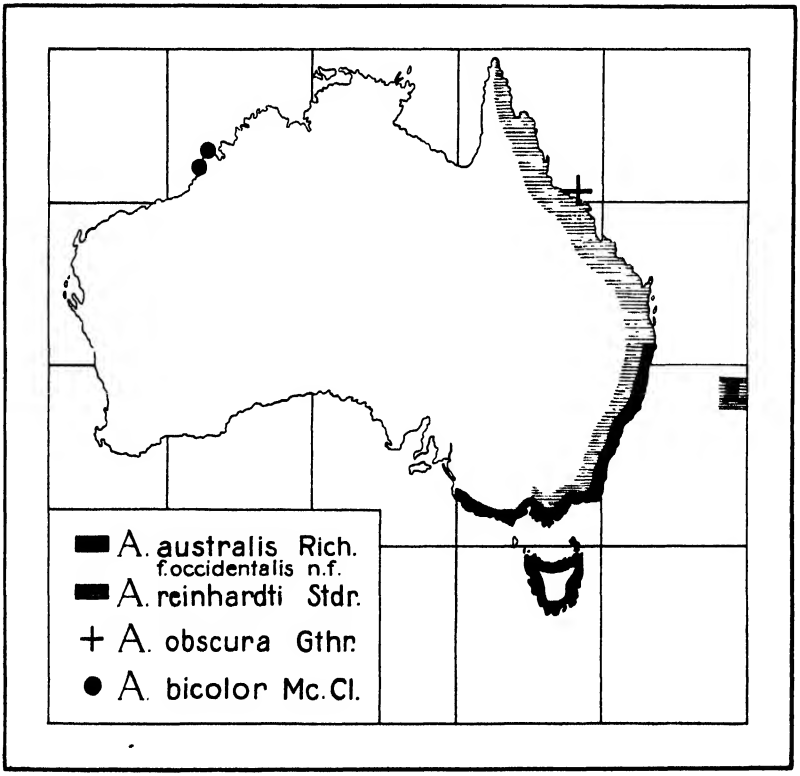

Fig. 13.—Distribution of the Australian eels according to the examination of a number of samples consisting of about 900 specimens.

And I may add, Is it found farther west than Melbourne on the south coast, and farther west than Cape York on the north coast? Does it occur in Tasmania and the adjacent islands?

2.—ANGUILLA AUSTRALIS *Richardson.*

The Short-finned or Unspotted Eel.

The chart in Fig. 13 shows that *Anguilla reinhardti* is a tropical species, extending far into the temperate zone, *Anguilla australis* on the other hand appearing as a decidedly temperate species. It has not hitherto been found in Queensland. The most northerly find recorded is from the Richmond River, in the northernmost part of New South Wales; I investigated a sample of eel-young from here, sent by the Australian Museum, Sydney (Reg. No. I.1113). The sample consisted of 8 *Anguilla reinhardti,* 49-54 mm. long, and 1 *Anguilla australis* 51 mm. long. That this specimen really was an *Anguilla australis* is fully apparent from the fact that it was found to have 46 + 66 = 112 vertebræ, with an $(a-d)$ percentage of 1·00 (*cf.* Figs. 3 and 5).

There is naturally no doubt but that *Anguilla australis,* which has proved so common in the neighbourhood of Sydney, exists along the whole range of coast between Richmond River and Sydney; no specimens have, however, been received from intermediate localities. Mr. Gilbert P. Whitley, of the Australian Museum, Sydney, in a letter dated 10th August, 1927, writes as follows: "*Anguilla australis* evidently rarely goes as far as 30° S. Lat., though our knowledge of the fishes along the coasts between Brisbane and Sydney is scanty. Its numbers appear to become thinner at about the Broken Bay district. We have, however, one specimen (No. I.1113, part), identified by yourself as *Anguilla australis,* from the Richmond River, New South Wales, which appears to be the northernmost locality for this species in Australia."

In the State of Victoria, *Anguilla australis* is unquestionably the commonest species. I have not myself seen samples from any locality west of Warrnambool (samples from here kindly forwarded by Mr. J. A. Kershaw, National Museum, Melbourne, and Mr. F. Lewis, Chief Inspector of Fisheries and Game, Melbourne). I cannot entertain any doubt, however, but that it is *Anguilla australis,* which is found farther west, right to the western limit of occurrence of fresh-water eels on the south coast of Australia, in the Mount Gambier district of South Australia.[9]

In Tasmania, *Anguilla australis* is evidently common, to judge from the samples I have seen; the same appears to be the case

[9] Zietz.—Trans. Roy. Soc. S. Austr. XXXII, p. 297, 1908. *See also,* in my paper "On the Distribution of the Fresh-water Eels (*Anguilla*) throughout the World," II, p. 346, 1925, the data furnished by T. S. Hall, who places the western limit between Mount Gambier and Beachport (about 140° E. long.).

in Flinders and Vansittart Islands; a sample was kindly sent me by Mr. H. Gottlieb, Lady Barron, Flinders Island. The species will probably also prove to be common on the other islands in Bass Strait.

Unfortunately, I am unable to contribute any information as to the length and weight attained by *Anguilla australis,* as the specimens I have had for investigation were, with a few exceptions, small ones. The largest I have seen came from Prospect Reservoir, and measured 88 cm. in length, weighing 1,225 grammes; it is, however, beyond doubt that the species attains a far more considerable size. A sample of *Anguilla australis* sent me from Christchurch, New Zealand, contained several specimens close on 1 metre long.

I close this discussion with the questions: What length and weight are attained by the Australian short-finned or unspotted eel, *Anguilla australis?* Is it found north of Richmond River, *i.e.* does it penetrate into the State of Queensland? And how far west is it met with on the south coast of Australia?

In the preceding, when dealing with *Anguilla reinhardti,* I mentioned that the populations of this species found outside the continent of Australia do not appear to be racially distinct from those of the mainland. This holds good, as far as our investigations extend, both as regards the populations in New Caledonia and Lord Howe Island, as shown by the average noted on p. 192.

What is now the position of *Anguilla australis* in this respect?

In my work on "The Fresh-water Eels of New Zealand,"[10] I have given a detailed account of our investigations of a great amount of material of *Anguilla australis* from New Zealand. I there refer to Figs. 3 and 6, where the $(a - d)$ percentage and the total number of vertebræ respectively for samples from New Zealand are shown in graphical form. On comparing these characters for the New Zealand samples with the same characters in the samples from Australia (see Figs. 3 and 5 in the present paper), it will be seen that there is a difference which cannot be ignored. The averages for these two characters in the samples from Australia and New Zealand respectively are as follows (figures in parentheses indicate total number of specimens examined):

	Australia.	New Zealand.
$\frac{a-d}{t} \times 100$	1·27 (198)	2·41 (93)
Vertebræ	112·68 (190)	111·64 (165)

Keeping to the number of vertebræ, which is the more accurately determined of the two characters, we find, then, an average difference of 1 vertebra between Australia (Sydney) and

[10] Schmidt.—Trans. New Zealand Institute, lviii, 4 (in the press).

New Zealand (Waiapu, East Cape). Testing the two values by means of variational statistics, we obtain the following result:[11]

	Australia.	New Zealand.
No.	190	165
Average	112·679	111·642
σ (standard deviation) ..	± 1·230	± 1·049
P.E.A. (probable error of average)	± 0·0602	± 0·055
P.F.A. (probable fluctuation of average)	112·378-112·980	111·367-111·917

Those who are familiar with investigations based on variational statistics will see from the preceding that there is a real difference in the number of vertebræ between the *Anguilla australis* of the continent of Australia and those of New Zealand.

The table below shows the average number of vertebræ for all the 29 samples of *Anguilla australis* which we have investigated, both from New Zealand and from the continent of Australia *et cetera*. It will be observed that there is a decided difference, apparent in all samples; the averages for Australian samples are invariably over, those for the New Zealand samples invariably under 112. Zoologists not conversant with the methods of variational statistics will perhaps find this simple arrangement of the averages more convincing proof that there exists, as above mentioned, a real difference in the number of vertebræ between the *Anguilla australis* of Australia and those of New Zealand.

Anguilla australis Rich., average number of vertebræ in 29 samples:[12]

Australia and Lord Howe Island.

Prospect Fish Hatchery, N.S.W.—13.v.1905	a	(25)	= 112·52
Prospect Reservoir, near Sydney.—Sept., 1914	a	(19)	= 112·37
Prospect Trout Ponds.—12.viii.1925	a	(45)	= 112·93
Sydney Water Supply Reserve.—Feb.-Aug., 1924	a	(20)	= 113·00
Maroubra, near Sydney (Mus. Sydney, I A 2642).—27.ix and 18.x.1925	a	(12)	= 112·75
Marley Beach, S. of Port Hacking (Mus. Sydney, I A 2972). —6.xi.1926	a	(81)	= 112·58
Long Bay Beach, N.S.W. (Mus. Sydney, I A 2959).—29.ix.1926	a	(19)	= 112·79
Hopkins River, Warrnambool, Victoria.—Dec., 1909	a	(35)	= 112·51
Melbourne, 1st sample.—1925	a	(109)	= 112·51
Melbourne, 2nd sample.—1925	a	(50)	= 112·72
Flinders Isl. and Vansittart Isl., Bass Strait	a	(22)	= 112·95
River Tamar, Tasmania	a	(17)	= 112·65
Lord Howe Isl., 1st sample.—Oct., 1924	a	(20)	= 112·75
Lord Howe Isl., 2nd sample	a	(27)	= 112·30
Lord Howe Isl., 3rd sample (Mus. Sydney, I A 3251).—late 1926	a	(34)	= 112·65

[11] *Cf.* Johs. Schmidt.—"First and Second Report on Eel Investigations," Vol. XVIII and Vol. XXIII des Rapports et Procès-Verbaux du Conseil International pour l'Exploration de la Mer, Copenhagen, 1913 and 1915.

[12] Figures in brackets indicate number of specimens examined.

New Zealand.

Pipiriki, Wanganui River.—18-26.ii.1926	a	(41)	= 111·78
Thames and Kaipara Harbour Streams, N. Auckland.—Jan., April, 1925	a	(98)	= 111·89
Wairua R., a branch of the N. Wairoa R., Whangarei, N. Auckland.—12.ii.1927	a	(94)	= 111·51
Hawkes Bay, near Napier.—Oct., 1926	a	(36)	= 111·47
Poropora Stream, Waiapu, East Cape District.—21.xi.1926	a	(165)	= 111·64
Christchurch.—1912	a	(110)	= 111·55
Waimakiriri River.—5 and 14.x.1925	a	(95)	= 111·92
Waimakiriri, 1st sample.—End of Oct., 1926	a	(89)	= 111·52
Waimakiriri, 2nd sample.—End of Oct., 1926	a	(40)	= 111·35

New Caledonia.

Caniveaux de Nouméa.—26.v.-19.vii.1926	a	(159)	= 111·57
Marais de Magenta.—Sept., 1926	a	(50)	= 111·84
Magenta and Dumbéa.—26.ix.-23.x.1926	a	(13)	= 111·69
Plum.—24.ii.1927	a	(28)	= 111·71
Caniveaux de Nouméa.—11.iii.1927	a	(11)	= 111·45

On the basis of the preceding, I propose that this difference—which appears not only in the total number of vertebræ but also in the number of præhæmal and caudal vertebræ and in the $(a-d)$ percentage—as between the populations of *Anguilla australis* in Australia and those in New Zealand should be emphasized by naming the former:

ANGUILLA AUSTRALIS *forma* OCCIDENTALIS *n.f.*, and the latter ANGUILLA AUSTRALIS *forma* ORIENTALIS *n.f.*

And now, what is the position as regards *Anguilla australis* on Lord Howe Island and Norfolk Island? Do they belong to f. *occidentalis* or to f. *orientalis*?

In the 83 specimens from Lord Howe Island which we have examined, the average number of vertebræ was 112·59, and there can thus be no doubt but that these belong to f. *occidentalis*.

In the case of Norfolk Island, we have only been able to examine 5 specimens, which is not a sufficient number to permit of any definite decision. The figures for these 5 were 113, 113, 112, 111 and 111 vertebræ respectively (average 112·0), and the $(a-d)$ percentages 2·1, 4·5, 2·6, 3·0 and 2·1 (average 2·86). The probability here is rather in favour of f. *orientalis*, the high $(a-d)$ percentage especially pointing in this direction.

In my own oft-quoted work "On the Distribution of the Fresh-water Eels (*Anguilla*) throughout the World,"[18] I stated that *Anguilla australis* "must probably be subdivided." I had not then seen sufficient material, and was obliged to leave the question open. There will no doubt be a number of zoologists, not

[18] Schmidt.—Mem. Acad. Roy. Sci. et Lettres de Danemark (8), x, 4, 1925, p. 366.

accustomed to base their classification on so delicate an analysis as that of variational statistics, who will consider an average difference of one vertebra as too slight a foundation for the establishment of two new forms. I must here point out, however, that the difference between the European and the East-Asiatic eel (*Anguilla vulgaris* Turton and *Anguilla japonica* Schlegel) is only very little more, *viz.* about 1·1 between the average numbers of vertebræ.[14]

I was particularly interested in demonstrating this slight average difference between the two forms *occidentalis* and *orientalis*, as I have no doubt but that it indicates a difference in their life-history and in their breeding-places. On comparing a depth chart with a chart showing the occurrence of the two forms, one can hardly doubt but that it is the New Caledonian submarine ridge, running north-west and north from western New Zealand, which separates the two forms, f. *occidentalis* breeding in the deep basin west of the ridge, and f. *orientalis* on the east of this barrier. A fact which also points in this direction is that we have succeeded in showing, firstly that *Anguilla australis*, hitherto known only from temperate regions, is met with *en masse* in the tropical island of New Caledonia, and further, that it is f. *orientalis*, i.e. the New Zealand form, which occurs there (see Table p. 198, and later Section v with Fig. 14). Investigations in the waters concerned, similar to those which I carried out in the Atlantic in 1920-1922, would be required to locate more precisely the actual breeding places of the two forms.

Up to the present, the ascent of enormous hosts of young transparent *elvers* (eel young) from the sea, to fresh waters inland, as witnessed in Europe, America, and Japan during the spring, has never been recorded in Australia. Our Australian colleagues have, however, taken up the matter for investigation, and I have before me a small collection of young *Anguilla australis* taken on the 29th September, 1926, in a creek crossing the beach at Long Bay, near Sydney, by Dr. C. Anderson and Mr. Gilbert P. Whitley (Australian Museum, Reg. No. I.A.2959). None of these is a quite young transparent elver; there are, however, some fairly young stages (stage vi A ii according to the terminology introduced by A. Strubberg[15]); the lengths of these varied from 47 to 57 mm. We have also examined a few specimens of *Anguilla reinhardti*, *e.g.* a small sample of 4 (Australian Museum I.A.708) taken on the 12th March, 1922, in a rock-pool at Coogee, near Sydney, by Messrs. F. A. McNeill and A. A. Livingstone. The length of these varied from 45·5 to 48 mm. but the stage was indeterminable, as the pigment had disappeared.

[14] Schmidt.—First Report on Eel Investigations, Rapports et Procès-Verbaux du Conseil International pour l'Exploration de la Mer, Vol. XVIII, p. 16, Copenhagen, 1913, where it is noted that *Anguilla vulgaris* has 114.728 and *Anguilla japonica* 115.876 vertebræ, average figures.

[15] Strubberg.—The metamorphosis of Elvers as influenced by outward conditions (Meddelelser fra Kommissionen for Havundersogelser, Ser. Fiskeri, Bind IV, No. 3, Copenhagen, 1913).

It is highly desirable that endeavours should be made to demonstrate the occurrence in Australia of transparent elvers in large numbers, in order to ascertain at what places and seasons this stage of development is to be met with, both as regards *Anguilla australis* and *Anguilla reinhardti.* I would here point out that elvers should *not* be preserved in alcohol, which is a bad preservative as far as they are concerned, but in a weak solution of formol (2-4%). For the rest, I would refer to the article by H. K. Anderson and G. P. Whitley.[16]

3.—Anguilla bicolor *McClelland.*

The Short-finned Eel of the Indian Ocean.

The chart, Fig. 13, shows that we have only found this species in the tropical part of Western Australia. For the rest, it occurs along the shores of the Indian Ocean, both in East Africa with Madagascar *et cetera,* and in British India and the Dutch Indies.

The first find of this species in Australia was made by a Norwegian explorer, Dr. Knut Dahl, who gives an interesting description of how the specimens lived buried deep down in the mud in a salt marsh, so that one had to dig them out with spades. The locality was Broome. about 20 miles north of Roebuck Bay (about 18° S. lat.). We have examined the 7 specimens brought home by Dr. Dahl, which are preserved in the Museum at Christiania; they were referred by Rendahl[17] to *Anguilla australis* Rich. The teeth-bands in the upper jaw of one of these specimens is shown in Fig. 10*a* in the present paper. I have further seen two female specimens of this species sent me through the Royal Danish Consulate at Perth, from the Chief Inspector of Fisheries, Mr. F. Aldrich, W. Australia. The two specimens referred to were secured at a waterhole inland from Beagle Bay, about 65 miles north of Broome. The lengths were 64 and 61 cm.; number of vertebræ $43 + 65 = 108$ and $43 + 47 = 110$, the $(a - d)$ percentage $-0{\cdot}5$ and $-1{\cdot}0$ respectively.

Anguilla bicolor is thus known up to the present only from a restricted area in north-western Australia. It would be most interesting to ascertain how far south this tropical species extends, and also its northern limit of distribution.

4.—Anguilla obscura *Günther.*

The Short-finned Eel of the Tropical Part of the South Pacific.

In a paper by W. Macleay, "Notes on a collection of fishes from the Burdekin and Mary Rivers, Queensland,"[18] there is a

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[16] Anderson and Whitley.—The Australian Museum Magazine, II, 8, pp. 266-270, 1925.

[17] Rendahl.—Meddelelser fra det zoologiske Museum, Kristiania, No. 5, 1922.

[18] Macleay.—Proc. Linn. Soc. N. S. Wales, VIII, p. 210, 1884.

description of a new species, *Anguilla marginipinnis* Macleay, from the Lillesmere Lagoon, Burdekin River. In my work "On the Distribution of the Fresh-water Eels (*Anguilla*) throughout the World,"[19] I stated, after noting *Anguilla australis* and *reinhardti*: "From the tropical part of the east coast (Burdekin, Queensland) Macleay (1884, p. 210) has described a long-finned, uniformly coloured species, *Anguilla marginipinnis*. There are thus at any rate three *Anguilla* species in eastern Australia, but I cannot say what *A. marginipinnis* may be without having seen a specimen."

By the courtesy of the Australian Museum at Sydney, we have been enabled to examine here at the Carlsberg Laboratory the 6 co-types of *Anguilla marginipinnis* preserved in that Museum, which are labelled "A.17994, A.17995, A.17997, A.17998, A.17999, A.18001, Lillesmere Lagoons, Burdekin River, Queensland, coll. A. Morton, 1883." The specimens were in poor condition, but careful investigation and close examination of X-ray photographs of them showed that 5 of the specimens belonged to *Anguilla reinhardti*, and the sixth to *Anguilla obscura* Günther. The name *Anguilla marginipinnis* must therefore disappear.[20]

The specimen of *Anguilla obscura* (A.17998) was about 67 cm. long, with 42 + 64 = 106 vertebræ and an $(a-d)$ percentage of 4·2; the teeth-bands of the upper jaw are shown in Fig. 10*b*.

With the disappearance of *Anguilla marginipinnis* then, we have at the same time to note *Anguilla obscura* as a further species of *Anguilla* living in Australia; it is also distributed throughout the tropical parts of the Pacific south of the Equator, from southern New Guinea to Tahiti. A further description of the species, with illustrations, is given in my paper "Les Anguilles de Tahiti,"[21] to which reference may be made. The species was originally established by Günther in 1872,[22] who described it more fully subsequently[23] (1910). Fortunately his type still exists (in the British Museum) and it was from examination of this, and from X-ray photographs of it, that we were able to demonstrate that *Anguilla obscura* is actually an extremely well established species, differing considerably from the other short-finned species of *Anguilla*; it has also been found to have a very characteristic area of distribution in the tropical waters of the Pacific south of the Equator (see Section v, and Fig. 14).

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[19] Schmidt.—Mem. Acad. Roy. Sci. et Lettres de Danemark (8), x, 4, 1925, p. 345.

[20] I give here the number of vertebræ and $(a-d)$ percentages for these 5 specimens of *Anguilla reinhardti*:

Vertebræ: 42 + 66 = 108, 42 + 66 = 108, 43 + 62 = 105, 44 + 65 = 109, 43 + 65 = 108.

$\frac{a-d}{t} \times 100$: 11·4, 11·6, 10·9, 7·6, 10·2.

The dentition shown in Fig. 9*c* is from one of these specimens.

[21] Schmidt.—La Nature, Paris, 15th July, 1927.

[22] Günther.—Proc. Zool. Soc., 1871 (1872), p. 673.

[23] Günther.—Journal des Museum Godeffroy, VI, 17 (Garrett's Fische der Südsee, IX), 1910, p. 392.

Finally, it will be interesting to compare our material according to States. We find the following distribution:

Queensland: 35 *Anguilla reinhardti* + 1 *Anguilla obscura.*
New South Wales: 305 *Anguilla australis* + 155 *Anguilla reinhardti.*
Victoria: 242 *Anguilla australis* + 4 *Anguilla reinhardti.*
Western Australia: 9 *Anguilla bicolor.*

It would be unreasonable to suppose that this small amount of casually collected material should be regarded as representative. Nevertheless I do not doubt but that it does give, to some extent, an idea of the actual conditions. Taking, for instance, the percentage of *Anguilla reinhardti* and *Anguilla australis* in the different States from north to south, we find the following:

	Anguilla reinhardti.	*Anguilla australis.*
Queensland	100%	0%
New South Wales	33%	67%
Victoria	2%	98%

Even though these figures may not be representative, there can hardly be any doubt as to the correctness of the order of precedence.

We know, then, four species of *Anguilla* from Australia. There would, presumably, be nothing to prevent two others from finding their way to the tropical part of Queensland, *viz. Anguilla megastoma* Kaup and *Anguilla mauritiana* Bennett. Both these species occur, for instance, in New Caledonia. Both are figured and mentioned in my work on "Les Anguilles de Tahiti."[24] In the tropical part of Western Australia one might perhaps expect to find, in addition to *Anguilla bicolor*, also the Indian form of *Anguilla mauritiana*, possibly also *Anguilla celebesensis* Kaup.

It is a remarkable fact that the common New Zealand eel, *Anguilla aucklandi* Rich., has not been met with either in Australia or on Lord Howe Island.

IV. SUMMARY.

I shall in the following pages, for the sake of convenience, give a brief summary of the essential facts.

1. ANGUILLA REINHARDTI *Steind.*, the *long-finned* or *spotted* eel.

Chief characteristics: Spotted; long-finned (Fig. 4); comparatively small mouth (cleft of mouth extending to hind margin of eye or a little farther, Fig. 1); maxillary and mandibulary teeth-bands divided longitudinally by toothless groove (Figs. 9*a, b, c*). Pacific, tropical and temperate (Fig. 13).

[24] Schmidt.—La Nature, Paris, 15th July, 1927.

Numerical characters: Total number of vertebræ: 104-110, average: 107·72 (Fig. 5 B); præhæmal vertebræ: 41-44, average: 42·59 (Fig. 6 B); branchiostegal rays: 10-12, average: 10·06 (Fig. 7 B); rays in right pectoral fin: 16-20, average: 18·20 (Fig. 8 A); $(a-d)$ percentage: 7·8 to 13·2, average: 10·72 (Fig. 3 A).

Distribution: Pacific, from Cape York to Melbourne on the Australian continent; also known from Lord Howe Island and New Caledonia.

2. ANGUILLA AUSTRALIS *Rich.* f. OCCIDENTALIS n.f., the *short-finned* or *unspotted* eel.

Chief characteristics: Unspotted; short-finned (Fig. 4); small mouth (cleft of mouth extending about to hind margin of eye, Fig. 1); no toothless groove, vomerine band most often distinctly shorter than maxillary bands, often shaped like the clapper or tongue of a bell, its greatest breadth at or rather behind the middle (Figs. 9*d*, *e*, *f*). Pacific, temperate (Figs. 13 and 14).

Numerical characters: Total number of vertebræ: 109-116, average: 112·68 (Fig. 5 A); præhæmal vertebræ: 44-48, average: 46·35 (Fig. 6 A); branchiostegal rays: 10-14, average: 12·00 (Fig. 7 A); rays in right pectoral fin: 15-19, average: 16·85 (Fig. 8 B); $(a-d)$ percentage: – 1·5 to + 4·0, average: 1·27 (Fig. 3 B).

Distribution: Pacific, from Richmond River in New South Wales to 140° E. Long. on the south coast of Australia, Tasmania, Flinders Island, Vansittart Island; also Lord Howe Island (not New Zealand, which has *Anguilla australis* Rich. f. *orientalis* n.f.).

3. ANGUILLA BICOLOR *McClelland*, the *short-finned* eel of the *Indian Ocean*.

Chief characteristics: Unspotted, short-finned; large mouth (cleft of mouth extending beyond eye); no toothless groove, vomerine band not much shorter than maxillary bands, its greatest breadth most often in front of the middle (Fig. 10*a*). Indian Ocean, tropical (Figs. 13 and 14).

Numerical characters: Total number of vertebræ: 106-114; average: 109·34 (Fig. 11 A); $(a-d)$ percentage: – 2·4 to + 3·1, average: 0·88 (Fig. 12 B).

Distribution: Roebuck Bay and Beagle Bay, tropical part of Western Australia, also found on the other tropical shores of the Indian Ocean.

4. ANGUILLA OBSCURA *Günther*, the *short-finned* eel of the *tropical* part of the *South Pacific*.

Chief characteristics: Unspotted, short-finned; large mouth (cleft of mouth extending beyond eye); no toothless groove, vomerine band often considerably shorter than maxillary bands, its greatest breadth in front of the middle (Fig. 10*b*). Pacific, tropical (Figs. 13 and 14).

Numerical characters: Total number of vertebræ: 101-107, average: 103·90 (Fig. 11 C); (*a* – *d*) percentage: 1·8-6·5. average: 3·91 (Fig. 12 B).

Distribution: Burdekin (Queensland), also met with from southern New Guinea to Tahiti.

V. SOME REMARKS ON THE SHORT-FINNED SPECIES OF ANGUILLA.

The short-finned species of eels, three of which were mentioned in the preceding, inhabit the Indo-Pacific region from the east coast of Africa to Tahiti reckoning from west to east, and from the Philippines to New Zealand reckoning north to south. In earlier times especially, a great number of species was established among the short-finned eels, but in most cases they were not well founded, so that neither later writers nor the authors concerned have been able to recognize them. Consequently, the classification was in a chaotic state, and it is not surprising that Weber[25] and later Boulenger,[26] as also Weber and Beaufort[27] abandoned all distinction of species among the short-finned eels, combining them all under the name of *Anguilla australis* Richardson, established in 1841[28] on the basis of specimens from the temperate Pacific Region.[29]

This then was the position when I entered upon the study of the short-finned eels, and endeavoured to introduce the statistical method, working with some hundreds of specimens. It was soon found that "*Anguilla australis*" was not one species but a number of species, each with its own characteristic features and distribution; and there is no reason to doubt that, given a sufficient number of specimens from the whole of the Indo-Pacific region, the entire problem could be thoroughly solved by the aid of the statistical method.

This was the practical side of the matter. There remains the formal aspect, *i.e.* the question as to denomination of the species based on and separated by characters with which the earlier writers, who established and named species of short-finned eels had never

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[25] Weber.—"Versuch einer Revision der Indo-pacifischen Anguillidæ," Zool. Jahrbücher, Supplement XV, 1 Band, 1912.

[26] Boulenger.—Cat. Fresh-water Fishes of Africa, in the British Museum, III, 1915, p. 9.

[27] Weber and Beaufort.—Fishes of the Indo-Australian Archipelago, III, 1916, p. 249.

[28] Richardson.—Proc. Zool. Soc. London, p. 22, 1841.

[29] Weber, however, *l.c.* 1912, established the short-finned species *Anguilla spengeli*, based on the very large eyes. I have seen such large-eyed specimens among *Anguilla bicolor*, *obscura* and others, and do not consider the character of specific value any more than the large-eyed silvery stages of our European eels. Large eyes in *Anguilla* are a sign of approaching sexual maturity.

concerned themselves at all. In this respect, my view is that the decisive point in pleading for or against the retention of old names of species inadequately described from insufficient characters should be *whether authentic type specimens are preserved* or not. Only where the types exist is there any real possibility of ascertaining the valid characters and thus determining whether the name shall be retained.

As an example, I may mention *Anguilla obscura* Günther. This was described by Günther in 1872,[30] from a specimen from the Fiji Islands, but it has not been found again, or accepted by later writers; while Günther himself in his later work[31] still noted only the type of *Anguilla obscura* from Fiji, though a large number of other short-finned eels from the tropical part of the South Pacific are given under the names of *Anguilla virescens* Peters and *Anguilla sidat* Bleeker.

Jordan and Seale, in their "Fishes of Samoa,"[32] enumerating the *Anguilla* species of Oceania, note among short-finned species, besides the type of *Anguilla obscura* from Fiji, which they had not seen, *Anguilla sidat* Bleeker (Samoa, New Zealand) and *Anguilla australis* Richardson (Samoa, New Zealand, East Indies).

Jordan and Seale, as also Günther, were, as we now can see, faced with an impossible task in attempting to separate the short-finned species of Oceania without having recourse to numerical characters. Erroneous results were also naturally arrived at, as for instance the identification of the temperate *Anguilla australis* Rich. with forms from the tropical Pacific and the East Indies. The application of numerical characters to extensive material has obviated the difficulties here. As regards Günther's *Anguilla obscura,* it has further been found that it is really a very characteristic species, albeit not in respect of the characters noted by Günther. With regard to these, I may refer to the previous sections, and to Figs. 10 and 9 *d, e, f* as also Figs. 11, 12 and 5 A and 3 B; and I may add that the number of præhæmal vertebræ is characteristic in *Anguilla obscura* (in a sample from Tahiti, the average for 158 specimens was 41·28 as against 46·35 in *Anguilla australis*, see Fig. 6 A; and the numbers varied from 40 to 43). The type of *Anguilla obscura* preserved in the British Museum was examined by Mr. Vilh. Ege, M.Sc. and found to have 42 + 63 = 105 vertebræ, with an $(a - d)$ percentage of 5·4; these values correspond nicely to those given in the graphs Figs. 11 and 12.

The examination of Günther's specimens of *Anguilla virescens* and *Anguilla sidat* (Günther, *l.c.* p. 392, 1910) in the British

[30] Günther.—Proc. Zool. Soc. of London, 1871 (1872), p. 673.

[31] Günther.—Journal des Museum Godeffroy, VI, 17 (Garrett's Fische der Südsee, IX), 1910, p. 392.

[32] Jordan and Seale.—Bull. U.S. Bureau of Fisheries, XXV, 1906, p. 192.

Museum showed that the specimens from Oceania did not belong to these species, which were described from the Indian Ocean, but to Günther's own *Anguilla obscura*; as a matter of fact this is also the case with a specimen from Vavao, Tonga, which Günther (*l.c.* p. 391, 1910) refers to *Anguilla aneitensis* Günther: it had 41 + 64 = 105 vertebræ and an $(a - d)$ percentage of 5·3, values not found in *Anguilla aneitensis*, or, as it should be called, *Anguilla megastoma* Kaup, as to which see my account in "Les Anguilles de Tahiti."[33]

We have also been able to examine some of Jordan and Seale's specimens, preserved in the United States National Museum, as for instance that of "*Anguilla sidat*" noted on p. 392, *l.c.* as from Samoa, and one of the "*Anguilla australis*" from Apia, Samoa, mentioned on the same page. The former (U.S.N.M. 52489), which was 885 mm. long, had 41 + 63 = 104 vertebræ, and an $(a - d)$ percentage of 2·8; the latter (U.S.N.M. 52533), 159 mm. long, had 43 + 60 = 103 vertebræ and an $(a - d)$ percentage of 3·1. These values absolutely exclude all possibilities of the specimens being either the East Indian *Anguilla sidat* (the large specimen first noted) or the temperate *Anguilla australis* Rich. (the smaller one) and show that both specimens belong to *Anguilla obscura* Günther.

It would take too long to catalogue in detail all the specimens from various Museums in different parts of the world which were preserved under other names, but on investigation of numerical characters proved to belong to *Anguilla obscura*; I will merely note two specimens from Tahiti, determined by Kendall and Goldsbrough[34] as *Anguilla otaheitensis*, but which proved to be typical *Anguilla obscura* (U.S.N.M. 65731 and 65733, with vertebræ 42 + 63 = 105 and 42 + 62 = 104 respectively). I would also refer to my previously quoted work "On the Distribution of the Fresh-water Eels (*Anguilla*) throughout the World," II, 1925,[35] where several other instances are mentioned.

The chart Fig. 14 shows, by means of different signs, the occurrence of those species of short-finned eels which we have been able to distinguish by means of numerical characters. We find here that *Anguilla obscura*, which proved so admirable a subject for characterization by the statistical method, also exhibits a characteristic and natural range of distribution, throughout a zone lying between that of the temperate *Anguilla australis* forms in the south and that of *Anguilla pacifica* n. sp. which occurs north of the Equator, in the north. Altogether, the distribution of the forms into which I have, by these statistical investigations, divided the collective species "*Anguilla australis*" seems to argue strongly in favour of the delicate analysis which this method involved; the

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[33] Schmidt.—La Nature, Paris, 15th July, 1927.

[34] Kendall and Goldsborough.—Mem. Mus. Comp. Zool., Harvard, XXVI, 7, 1911, p. 244.

[35] Schmidt.—Mem. Acad. Roy. Sci. et Lettres de Danemark (8), x, 4, 1925.

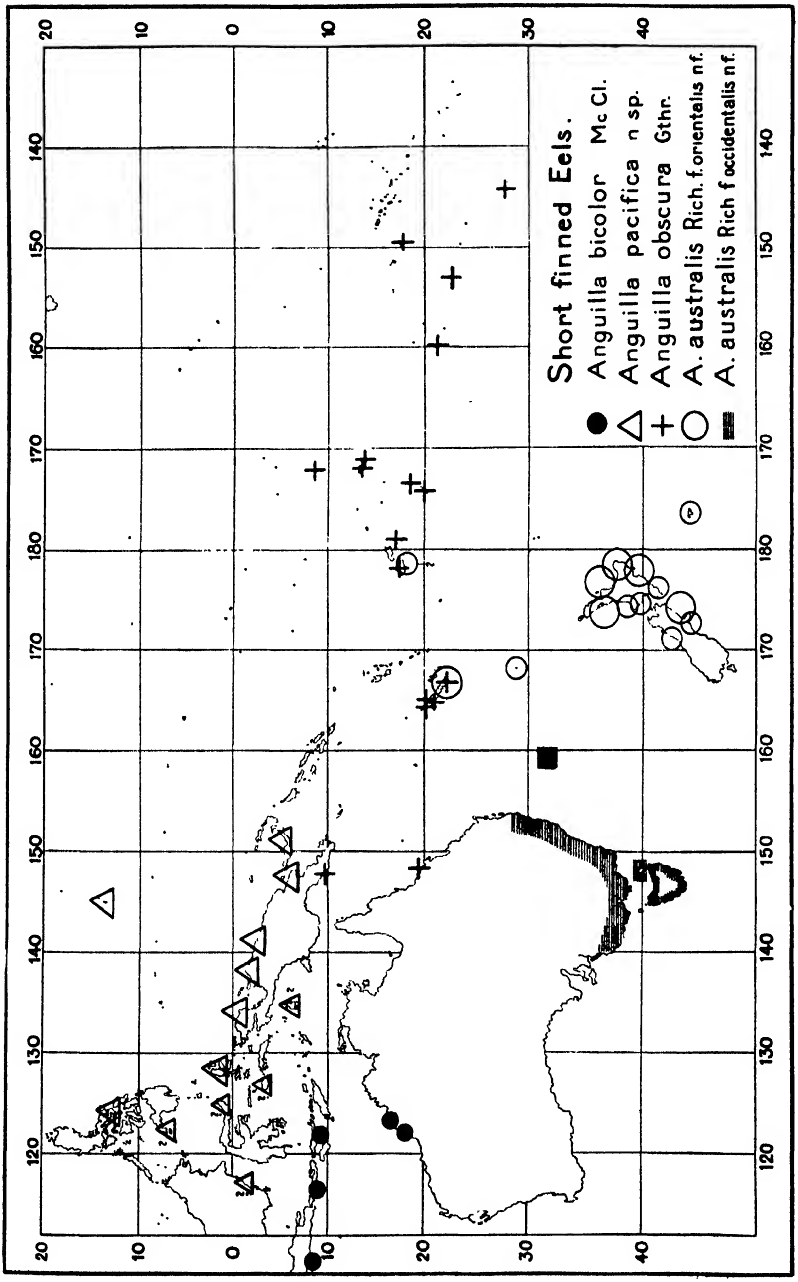

Fig. 14.—Distribution of the short-finned eels.

areas of distribution so found appear in every case natural and well founded.

In the Pacific, the species are distributed according to latitude as follows: North of, and close to, the Equator, a tropical species (*Anguilla pacifica* n. sp.), south of the Equator another tropical species (*Anguilla obscura* Günther) and south of this again the temperate *Anguilla australis* Rich., which is divided into two forms: a western, f. *occidentalis* n.f. belonging to Australia, and an eastern, f. *orientalis* in New Zealand and New Caledonia.

On the shores of the Indian Ocean, short-finned eels occur both in East Africa with Madagascar and other islands, in British India and from the northern extremity of Sumatra to north-western Australia. I have in this present work named them *Anguilla bicolor* McClelland. Up to now, I have not been able to demonstrate the existence of differences great enough to warrant division into species or forms between the populations in the western and eastern parts of the Indian Ocean; it should here be noted, however, that the material from the western part is still insufficient, and that I do not wish to take any final decision as to the nomenclature before enough material has been procured to permit of a thorough comparison of the populations of short-finned eels from the western and eastern parts of the Indian Ocean.

The short-finned eel living in the tropical part of the Pacific north of and close to the Equator I have named *Anguilla pacifica n. sp.* It is most nearly related to *Anguilla bicolor* from the Indian Ocean, but differs in having a smaller number of vertebræ, between 2 and 3 on an average, and a shorter $(a - d)$ than *Anguilla bicolor,* as will be seen from Figs. 11 and 12. The chart Fig. 14 shows where *Anguilla pacifica* has hitherto been found, *viz.* on the shores of that portion of the Pacific which is bounded by the Philippines on the west and New Guinea on the south. Owing to insufficiency of material, we cannot say how far the species extends towards the east; the most easterly finds up to now are from the island of Guam in the Marianne group and New Ireland (Neu Pommern).

In the easternmost part of the Dutch East Indies (shores of the Sea of Celebes, Banda Sea *et cetera*), also, short-finned eels are found, and I have seen a small number of specimens from these localities. They are not identical with *Anguilla bicolor* from the Indian Ocean, but seem rather more nearly related to *Anguilla pacifica*; no final decision, however, can be arrived at from the material at present available. We cannot yet say whether they breed in this Archipelago, where there are, of course, great depths, or whether the populations living there consist of individuals immigrated as larvæ from the Pacific Ocean.

Finally, we come to the short-finned eels of the temperate zone: *Anguilla australis* Rich. with its two forms *occidentalis* and

orientalis, the former from the Australian continent, Tasmania and Lord Howe Island, the latter from New Zealand (see Fig. 14). I have long fancied that the eels of the temperate regions (New Zealand and Australia) must have their breeding places in the neighbourhood of the tropics, as with the eels of Europe and North America, migrating northward from New Zealand and the south-east coast of Australia in order to breed. It is only since we succeeded in ascertaining the relation between the temperate *Anguilla australis* and the tropical short-finned eels like *Anguilla obscura,* that the way was open for further exploration of the life-history of *Anguilla australis.* On going through the material of short-finned eels from Oceania preserved in the museums, we found numbers of specimens which, from the very small number of vertebræ, as a rule 103, 104 or 105, were at once recognizable as *Anguilla obscura.* Among all these numerous specimens of *Anguilla obscura* from the whole long range between New Guinea and Tahiti there was one which attracted special attention. It was preserved in a collection kindly placed at our disposal for examination by the Hamburg Museum, marked No. 2415, Godeffroy, 1877, Viti Levu, Fiji. We had already seen several typical specimens of *Anguilla obscura* from Fiji with 103-106 vertebræ; this specimen, however, when photographed by the X-rays, was found to have $46 + 67 = 113$ vertebræ, with an $(a - d)$ percentage of 2·1; in other words, we had here a specimen of the true temperate *Anguilla australis* Rich. taken in the tropical zone. This discovery could not but confirm my idea that the breeding places of *Anguilla australis* lay far to the north, near the tropics. On the other hand, we had only the evidence of a single museum specimen, and that an old one, while previous painful experience in several cases had taught us that museums in earlier times were not so particular about the precise locality of their finds. My endeavours were therefore directed towards the procuring of further and extensive material of short-finned eels from Fiji; up to the present, however, without result. Naturally, I also tried to obtain material from the other groups of islands which might be considered in this connection, especially New Caledonia and the New Hebrides. From the latter group I have no result as yet. Otherwise, however, as regards New Caledonia, I have in the first place seen the collection procured by F. Sarasin and J. Roux, examined by Weber and Beaufort.[36] The short-finned eels in this connection were referred by Weber and Beaufort to their collective species *Anguilla australis,* which as we have seen from our investigations, is not the same as *Anguilla australis* Rich. X-ray photographs showed that the specimens belonged to *Anguilla obscura*[37] with one exception, this being rather an intermediate form between *Anguilla bicolor* and *obscura.* None of them was *Anguilla australis* Rich. The extant collections from New Caledonia thus afforded

[36] Weber and Beaufort.—Les Poissons d'eau douce de la Nouvelle Calédonie" *in* Sarasin and Roux: Nova Caledonia, Zoologie, II, 1, 2, Wiesbaden, 1915, p. 20.

[37] The nos. of vertebræ were as follows: 104, 105, 103, 105, 105, 105, 105.

no support for the theory as to occurrence of the temperate *Anguilla australis* Rich. in the tropics. In the course of the last two years, however, some large collections of fresh-water eels from the southern part of New Caledonia, have come into my possession. These collections, for which I have to thank the keen French zoologist, M. Jean Risbec, of Noumea, proved of great importance, containing several hundred specimens of short-finned eels. The examination of these was a great surprise. We had expected to find mainly the ordinary tropical species *Anguilla obscura*. This was present, it is true; but by far the greater number belonged to the temperate form *Anguilla australis*, with the large number of vertebræ. A survey of these samples is in the accompanying table, where the average number of vertebræ is noted.

Anguilla australis Rich. f. *orientalis* n.f., New Caledonia, 1926-27.

Locality.	Date.	Number of Specimens.	Average Number of Vertebræ.
Noumea	26/5-19/7, 1926	159	111·57
Magenta	Sept., 1926.	50	111·84
Magenta and Dumbéa	Sept., Oct., 1926.	13	111·69
Plum	24/2, 1927.	28	111·71
Noumea	11/3, 1927.	11	111·45

The specimens from Noumea were taken in gutters, and the majority of them were transparent elvers, some of them indeed very young, from Stage V A upwards.

On considering the average number of vertebræ in our samples of *Anguilla australis* from New Caledonia, also noted in the table on pages 197-198 for the Australian and New Zealand samples, we find that they belong to the New Zealand form, which was given the name of *Anguilla australis* Rich. f. *orientalis* n.f.

Altogether, the examination of the collections from New Caledonia must be said to have largely confirmed the supposition that the temperate *Anguilla australis* Rich. has its breeding places in the neighbourhood of the tropics. Taking all the available data regarding distribution of this species (see table on p. 197 and chart, Fig. 14), it is natural to suppose that the western form (f. *occidentalis*), which inhabits the continent of Australia *et cetera,* must have its breeding place in the basin on the west of the New Caledonian submarine ridge, the eastern form (f. *orientalis*), which lives in New Zealand *et cetera,* having its breeding grounds east of the barrier in question.

Carlsberg Laboratory, Copenhagen,
November 6, 1927.

STUDIES IN ICHTHYOLOGY.[1]
No. 2.

By

Gilbert P. Whitley, Zoologist, Australian Museum.

(Plates xvi-xviii and Figures 1-2.)

Family DASYATIDÆ.

Himantura granulata (*Macleay*).

(Figures 1-2.)

Trygon granulata Macleay, Proc. Linn. Soc. N. S. Wales, vii, pt. 4, April, 1883, p. 598. New Guinea. *Idem,* Garman, Mem. Mus. Comp. Zool. Harvard, xxxvi, 1913, p. 377. Wrongly inserted in synonymy of *Dasybatus gerrardi* (Gray).

Himantura granulata Jordan and Seale, Bull. U.S. Bur. Fish. xxv, 1906, p. 185. *Ex* Macleay. *Id.* Whitley, Journ. Pan-Pacif. Res. Inst., iii, 1, 1927, p. 11.

Re-description of holotype (Fig. 1).—Eye (25 mm.) 2·48 in interorbital (62), and equal in length to the spiracle. Length from snout to dorsal insertion of tail (313) 1·7 in length of tail (557). Width of jaw (27) 2·8 in distance from mouth opening to tip of snout (78). Distance between outer angles of first branchial slits (95) 3·5 in width of disc (335) which is less than length from tip of snout to end of pectoral (357). The distance between the lower gill-openings is equal to the distance from the first slit to the fifth. Ventral fins slightly longer than the interorbital is wide.

Body strongly depressed, the highest point just over the pectoral arch. Margins of fins rounded. Snout ending in a rounded obtuse angle.

Eyes large, twice as long as deep. A concave median area between and before eyes, the interorbital region having apparently collapsed in preservation. A series of posteriorly branching sensory canals visible at the surface on each side immediately before the pectoral arch. Skin thrown into convolutions forming papillæ around mouth; a row of pores in the papillæ over teeth in upper jaw. Teeth lozenge-shaped, close-set in oblique series, each with a cusp over its long axis. Upper buccal flap serrated like a cock's-comb with about 21 points. Two fairly large buccal papillæ with rounded but somewhat frayed edges. The fronto-nasal processes and naso-

[1] For No. 1, see "Records," xv, No. 5, 1927, p. 289

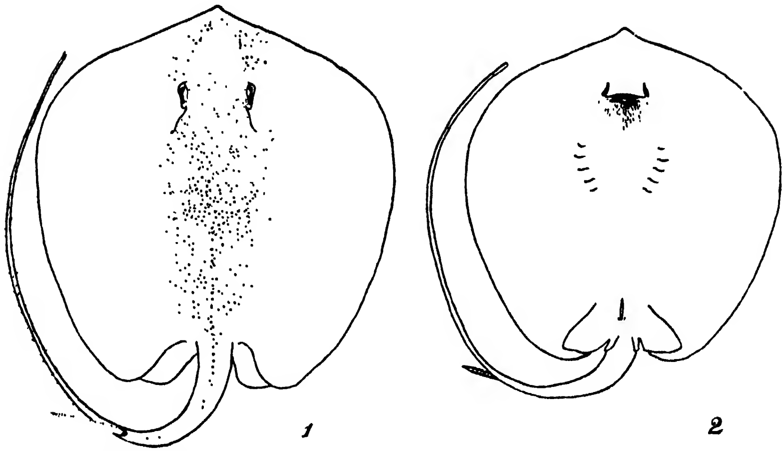

Fig. 1.—*Himantura granulata* (Macleay). Holotype female from Port Moresby district, Papua. Dorsal surface.

Fig. 2.—*Himantura granulata* (Macleay). Allotype male from Vanikoro, Santa Cruz Group. Ventral surface. Drawn to same scale as fig. 1.

G. P. Whitley, del.

buccal grooves have been distorted in preservation; there is a broad median septum. Margins of branchial slits somewhat S-shaped, their edges minutely frayed. The specimen is a female, but has been gutted in a way that obliterates the cloacal aperture. No prepelvic spines. Base of tail fleshy, without folds. The caudal spine has been removed; its base had been overlapped by a piece of papery brown skin. Scattered prickles stud the long tail, becoming smaller as they near the end, and disappearing before the tip, which is blunt, is reached. Head, back, and median line of tail to root of caudal spine evenly covered with thorny granules which are largest near the median line, but do not form a median row or differ amongst themselves except in size. Similar but minute granules extend over the snout and on the sides of the pectorals; they probably extended over the entire disc, but the sides of the type have been rubbed smooth. Ventral fins, ventral surface of disc, and sides and ventral surface of base of tail smooth.

Colour, after long preservation in formalin, brown, lighter below. Margins of ventral surface smoky brown. At least nine ill-defined, crescentic brownish markings along sides, now difficult to trace, but resembling those in Jordan and Starks' figure of the Samoan *Himantura fai.*[2]

Described and figured from the holotype of *Trygon granulata* Macleay, a female specimen, 34 inches long including the tail, and

[2] Jordan and Starks.—Bull. U.S. Bur. Fish. xxv, 1906, p. 184, fig. 2.

13 inches wide. Australian Museum regd. No. I.9763. It was collected in the early 'eighties by Andrew Goldie in the Port Moresby district, Papua.

Description of male allotype (Fig. 2).—A second specimen of *Himantura granulata* (1A.2867) was secured by E. Le G. Troughton and A. A. Livingstone from the reef off Sunday River, Vanikoro. It is a male, slightly smaller than the holotype, as may be seen from the figures, which are drawn to the same scale. In outline, it is rounder than the female, and the distal part of the tail is thicker. The entire disc is covered with granules dorsally; these become larger and spiny on the back and extend first in two rows, then in one, along the top of the tail to the origin of the caudal spine. Small prickles are scattered over the surfaces of the tail posterior to the spine as far as the tip. Ventrals fins smooth, their length slightly less than the interorbital width. The highest part of the body is over the back of the skull, the back and interorbital being evenly and convexly rounded. The mouth is tightly shut, so that examination of its internal features may not be made. The width of the fronto-nasal process is over twice its depth; a fine fringe extends along the posterior edge. The nostrils are wide, protected by a slightly twisted, rounded lobe which bears a small inwardly projecting process.

Length, without the tail, 11 inches. Tail 19½ inches. Width of disc 11½ inches. Length of cloacal aperture 21 mm. Abdominal pores distinct. Caudal spine 77 mm. long, barbs extend along the distal halves of the sides almost to the tip. Claspers small, unequal, grooved dorsally. Tail 29 mm. wide at base, originating about on a level with the insertions of the pectorals.

Colour in spirits light greyish-brown above, whitish below. Edges of snout and fins blackish ventrally. Claspers whitish, ventrals greyish. No ocelli.

Remarks.—The Museum collectors were singularly fortunate in securing a specimen of this little-known species at Vanikoro. Their example, further, is well preserved, and its colours and nasal characters are more easily studied than those of Macleay's type. The specimens described above, all that are known of this species, are evidently immature, and it is probable that *Himantura granulata* grows to a large size. I am unable to unite it with any other species of the genus known to me, and disagree with Garman,[3] who regarded *Trygon granulata* Macleay as a synonym of *T. gerrardi* Gray[4] from India.

Range.—Papua; Santa Cruz Archipelago, Melanesia.

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[3] Garman.—Mem. Mus. Comp. Zool. Harvard, xxxvi, 1913, p. 377.
[4] Gray.—List. Specim. Fish. Brit. Mus., i, Chondropt., 1851, p. 116.

Family CLUPEIDÆ.

Sub-family PRISTIGASTERINÆ.

Genus NEOSTEUS *Norman,* 1923.

Neosteus Norman, Ann. Mag. Nat. Hist. (9) xi, 1, Jan., 1923, p. 17.

Genotype.—Pellona ditchela Cuvier and Valenciennes[5] has been selected as the logotype of this genus in the "Zoological Record." This species is the only *Neosteus* known from Australian waters. It was recorded from between Cairns and Rockhampton as *Ilisha hœvenii* by McCulloch; Dr. W. E. J. Paradice, whose recent death was a great blow to marine biology in Australia, has collected it in the Edward Pellew Group, Gulf of Carpentaria.

Family PLOTOSIDÆ.

COPIDOGLANIS RENDAHLI, *nom. nov.*

Copidoglanis obscurus Rendahl, Medd. Zool. Mus. Krist. No. 5, 1922, p. 173. Glencoe and Hermit Hill, N.W. Australia.

The above name is preoccupied by *Copidoglanis obscurus* Günther,[6] so I propose *Copidoglanis rendahli* as a substitute.

Family HEMIRAMPHIDÆ.

Genus HEMIRAMPHUS *Cuvier,* 1816.

Hemi-Ramphus Cuvier, Règne Anim., ed. 1, ii, "1817" = Dec., 1816, p. 186. Haplotype, *Esox brasiliensis* Linnæus. *Id.* Schinz, Das Thierreich (Cuvier), ii, 1822, p. 313. *Id.* Cuvier, Règne Anim. ed. 2, ii, 1829, p. 285.

Hemirhamphus Voigt, Das Thierreich (Cuvier), ii, 1832, p. 383.

The original spelling is adhered to here.

HEMIRAMPHUS QUOYI *Cuv. and Val.*

Hemiramphus quoyi Cuvier and Valenciennes, Hist. Nat. Poiss. xix, 1846, p. 26. Port Dorey, New Guinea.

Hemirhamphus quoyi Bleeker, Atl. Ichth. vi, 1871, pp. 53 and 57, pl. cclii, Fig. 1. *Id.* Weber and Beaufort, Fish. Indo-Austr. Archip. iv, 1922, p. 154. *Id.* McCulloch and Whitley, Mem. Qld. Mus., viii, 2, 1925, p. 138. *Id.* Paradice and Whitley, Mem. Qld. Mus., ix, 1, 1927, p. 80, pl. xi, fig. 2.

Hemirhamphus quoyii Schmeltz, Cat. Mus. Godeff. vii, 1879, p. 57.

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[5] Cuvier and Valenciennes.—Hist. Nat. Poiss. xx, 1847, p. 314; ed. 2, p. 228. Based on Russell's "Ditchelee." Coromandel.

[6] Günther.—Cat. Fish. Brit. Mus., v, 1864, p. 26.

Belone quoyi Klunzinger, Sitzb. Akad. Wiss. Wien, lxxx, 1, 1879, p. 415 (91 of reprint). *Lapsus pro Hemiramphus quoyi.*

Tylosurus quoyi McCulloch and Whitley, Mem. Qld. Mus., viii, 2, 1925, p. 138. *Errore pro Hemiramphus quoyi.*

The species called *Belone quoyi* by Klunzinger and *Tylosurus quoyi* by McCulloch and Whitley belongs to the genus *Hemiramphus*. Schmeltz's record of *H. quoyi* from Bowen, Queensland (*loc. cit.*, supra), has been generally overlooked. The species is represented in the Australian Museum by specimens from Port Darwin, Gulf of Carpentaria, and several Queensland localities.

Family SOLEIDÆ.

SYNAPTURA SETIFER *Paradice.*

Synaptura setifer Paradice, Mem. Qld. Mus., ix, 1, 1927, p. 101, fig. 3. Port Darwin, Northern Territory of Australia. Holotype in Austr. Museum.

Mr. D. G. Stead collected one specimen, 196 mm. long, at Clyde Terrace Market, Singapore, on the 25th January, 1923 (Australian Museum registered number 1A.3189), so that the known range of this species is now considerably extended.

Family LUTJANIDÆ.

LUTJANUS CASTELNAUI, *nom nov.*

Genyoroge unicolor Alleyne and Macleay, Proc. Linn. Soc. N.S. Wales, i, 3, Feb., 1877, p. 266, pl. iv, fig. 1. Percy Is., N. Queensland. Not *Neomesoprion unicolor* Castelnau, Vict. Offic. Rec. Philad. Exhib., 1875, Intercol. Exhib. Essays No. ii, p. 8, from Cape York.

Lutianus unicolor Jordan and Seale, Bull. U.S. Fish. Bur., xxv (1905), 15 Dec., 1906, p. 263. *Id.* McCulloch and Whitley, Mem. Qld. Mus., viii, 2, 1925, p. 151 (ref. to Alleyne and Macleay only).

Since *Neomesoprion unicolor* Castelnau 1875 and *Genyoroge unicolor* Alleyne and Macleay 1877 are evidently both referable to the genus *Lutjanus* Bloch, a new name is required for the latter species, for which *Lutjanus castelnaui* is proposed.

Family APOGONIDÆ.

APOGONICHTHYS ISOSTIGMA *Jordan and Seale.*

Apogonichthys isostigma Jordan and Seale, Bull. U.S. Bur. Fish. xxv, 1906, p. 251, fig. 45. Samoa.

A specimen, 54 mm. long from snout to hypural joint, from Hook Island, Whitsunday Passage, Queensland, agrees excellently

with the description and figure quoted above. Mr. E. H. Rainford collected the specimen, which is registered number 1A.917 in the Australian Museum. New record for Australia.

Family LETHRINIDÆ.

Genus PENTAPODUS *Quoy and Gaimard,* 1824.

1824. *Pentapodus* Quoy and Gaimard, Voy. Uran. Physic, 1824, p. 294 [*ex* Cuvier MS.]. Haplotype, *P. vitta* Q. and G.

1829. *"Les Pentapodes"* Cuvier, Règn. Anim. ed. 2, ii, April, 1829, p. 184. Vernac. only. Haplotype, *Sparus vittatus* Bloch.

1830. *Leiopsis* Raffles, Mem. Life Stamford Raffles, Feb., 1830 (*fide* Sherborn), p. 688 [*ex* Bennett MS.]. Haplotype *L. rafflesii* (Bennett) Raffles.

1830. *Pentapus* Cuvier and Valenciennes, Hist. Nat. Poiss. vi, Sept., 1830 (*fide* Sherborn), p. 258. Latinized form of "Les Pentapodes." Logotype, *Sparus vittatus* Bloch.

1832. *Pentapus* Voigt, Das Thierreich (Cuvier), ii, 1832, p. 253.

1834. *"Pentapoda"* Griffith, Anim. Kingd. (Cuvier), x, 1834, p. 166. Used only as a vernacular.

1842. *Pentapodus* Agassiz, Nomencl. Zool., 1842, Pisces, p. 47. Latinized form of "Les Pentapodes" Cuvier. Logotype, by present designation, *Sparus vittatus* Bloch.

1843. *Mænoides* Richardson, Icon. Piscium, 1843, p. 8. Logotype fixed by Jordan (Classif. Fish., 1923, p. 197) as *M. aurofrenatus* Rich. = *Pentapus vitta* Cuv. and Val.

1873. *Gnathodentex* Bleeker, Versl. Akad. Amsterd. (2), vii, 1873, p. 41. Orthotype, *Pentapus aurilineatus* Bleeker (*fide* Jordan, Gen. Fish. iii, 1919, p. 367).

Note on priority.—Pentapodus Quoy and Gaimard, 1824, has precedence over *Leiopsis* Raffles, Feb., 1830 (*fide* Sherborn, Index Anim. ii, 1, 1922, p. civ) and *Pentapus* Cuvier and Valenciennes, Sept., 1830 (*fide* Sherborn, Ann. Mag. Nat. Hist. (9), xv, 1925, p. 600). In a letter, Mr. Sherborn informs me to the effect that Quoy and Gaimard's use of *Pentapodus* in 1824 is earlier than any publication of *Pentapus* or its variants as a genus of fishes, and that *Leiopsis* does not appear in literature before February, 1830.

PENTAPODUS SETOSUS (*Cuvier and Valenciennes.*)

Pentapus setosus Cuvier and Valenciennes, Hist. Nat. Poiss. vi, 1830, p. 270. Batavia. *Id.* Bleeker, Atl. Ichth. viii, 1877, pp. 100-101, pl. cccxxiv, fig. 1.

Labrus? iris Richardson, Ann. Mag. Nat. Hist., xi, 1843, p. 357 [*ex* Solander MS.]. Not "Le Labre iris" = *Labrus irideus* Lacépède, 1802, and not *Pentapus iris* C. and V., 1830. Off Bustard Bay, New Holland (Queensland).

Two specimens collected by Surgeon-Lieutenant L. Lockwood, H.M.A.S. "Moresby," in the Hervey Bay district. One, 225 mm. long, has a caudal filament of 91 mm.

Synonymy.—Labrus? iris was the manuscript name given by Solander to a fish caught on May 24, 1770, off Bustard Bay. Richardson published Solander's name and notes in 1843, since when this species has been listed as an unknown Labroid. Solander's description applies perfectly to *Pentapus setosus,* however, and the fish is probably the first described from Queensland.

Family SCATOPHAGIDÆ.

SCATOPHAGUS *sp. juv.*

(Plate xviii, fig. 2.)

D.x/18, preceded by 2 recumbent spines; A.iii/15. P.15? V.i/5; C.16.

Height of body (7 mm.) 1·7 in length from snout to end of middle caudal rays (12).

Forehead covered by a very strong bony protuberance, 3 mm. wide, with a slight median crest. Similar bony protuberances over and in front of eyes, and two over the operculum, of which the posterior forms a thick spine. A median callosity on the top of the head ends in a backwardly projecting spine just before the recumbent spines preceding the first dorsal. Other bony excrescences occur above and below the mouth, along the preopercular limbs, and over the shoulder. All are smooth and roundly elevated; the skin between them resembles that of the body.

Body strongly compressed, without scales, but covered with close-set minute papillæ except along the continuous lateral line. Margins of fins rounded; caudal emarginate.

Colour uniformly dark brown after preservation in alcohol; the soft dorsal, anal, caudal, and pectorals hyaline.

Described and figured from a single larva, 12 mm. long, in the Australian Museum; regd. No. 1A.1811. It was collected at Port Denison, Queensland, by Mr. E. H. Rainford.

I refrain from suggesting the specific identity of this specimen as it does not agree exactly with the figures and descriptions of young *Scatophagus* available to me.[7] Our knowledge of the Australian species is not sound at present, and further material is required before the various nominal species can be satisfactorily determined; those recorded from Queensland have been listed by McCulloch and Whitley.[8]

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[7] *Vide* Lütken.—Spolia Atlantica (Vidensk. Selsk. Skr., 5 Række, naturv. og math. xii, 6), 1880, pl. v, fig. 7.
Weber.—Siboga Exp., Monogr. lvii, 1913, pl. x, figs. 1-5.
Johnstone.—Rept. Pearl Oyster Fisher. G. of Manaar, pt. ii, 1904, Suppl. Rept. xv, p. 220, pl. i, fig. 1.
Hora.—Mem. Asiat. Soc. Bengal, vi, 1924.
Seale and Bean.—Proc. U.S. Nat. Mus., xxxiii, 1907, p. 246, fig. 8.

[8] McCulloch and Whitley.—Mem. Qld. Mus. viii, 2, 1925, p. 159.

Family POMACENTRIDÆ.

AMPHIPRION PAPUENSIS *Macleay.*

(Plate xvii, fig. 2.)

Amphiprion papuensis Macleay, Proc. Linn. Soc. N.S. Wales, viii, 2, July, 1883, p. 271. D'Entrecasteaux Group, New Guinea. *Id.* McCulloch and Whitley, Mem. Qld. Mus., viii, 2, 1925, p. 166.

A young specimen, 8·8 mm. in total length, has the following characters. Two nostrils on each side of snout. A row of about six pores along limb of preoperculum, which is denticulated at its angle. Operculum subvertical, with a superior flap, and two denticulations at its angle. The opercular serrations characteristic of the genus have not yet appeared. A notch between the transparent interoperculum and the suboperculum; under the former may be seen the branchiostegal rays. Eye very large, about 2·5 in head, its diameter subequal to interorbital. Minute teeth in jaws. Tongue well developed. Gill-rakers slender.

Body long, compressed, scaleless. Depth a little greater than length of head. Pectorals rounded, shorter than head. Fins well developed, though their spines and rays may not be counted with accuracy; there appear to be fifteen principal rays in the caudal. About 23 myomeres.

Colour, in spirit, brownish, with four creamy-yellow irregular transverse bands; the first embraces the head in advance of the eyes and has an indistinct margin; the second tapers from the nape to the bottom of the gill-covers; the third joins the anterior portions of the soft dorsal and anal, and the last includes the whole of the tail. The fins are also creamy-yellow, but, where they are adjacent to the brown parts of the body, a small amount of dark pigment invades them.

This specimen is probably the smallest *Amphiprion* known. It was collected by Mr. E. H. Rainford at Holbourne Island, off Port Denison, Queensland. Australian Museum, regd. No. 1A.621.

The specimen is evidently the young of *Amphiprion papuensis* Macleay, the type of which, in the Australian Museum, I have examined. This species is characterized by having a light coloured snout, breast, soft dorsal, pectorals and tail. The first dorsal, ventrals, anal and base of pectoral of the type are blackish. *Amphiprion papuensis* was first noticed from Australia by McCulloch and Whitley (*loc. cit.*) from specimens collected by Mr. Rainford in Whitsunday Passage, Queensland.

CHROMIS SCOTOCHILOPTERUS *Fowler.*

Chromis scotochilopterus Fowler, Proc. Acad. Nat. Sci. Philad., lxx, 1, 1918, p. 61, fig. 24. Philippine Islands.

Chromis xotochilopterus Regan, Zool. Record, lv (1918), 1920, p. 17. Error.

A young specimen, 53 mm. long from snout to hypural joint, has the following characters: D.xii/12; A.ii/11; tubes in upper arch of lateral line 16-17. Upper profile of head less gibbous than that figured by Fowler; eye large (6 mm.), 2·1 in head (13), due perhaps to the juvenile condition of the specimen. The membranes of the first dorsal are less produced and the soft dorsal and anal fins more pointed than those of the typical *C. scotochilopterus*. The colouration, however, is similar, and, since the specimen otherwise agrees in all major respects with Fowler's description, I do not regard the Queensland form of this species worthy of nominal distinction.

Loc.—Outer Barrief Reef, Queensland, between 17° and 19° S. lat.; coll. Dr. W. E. J. Paradice, R.A.N., 1924. Regd. No. 1A.2294.

New record for Australia.

TETRADRACHMUM NITIDUM, *sp. nov.*

(Plate xvii, fig. 3.)

D.xiii/12; A.ii/10; P.18; V.i/5; C.14. Lateral line with 17 tube-bearing scales and about 9 punctured scales along caudal peduncle.

Head (16 mm.) 3·7 in the length to the hypural joint (60). Depth (25) 2·4 in the same. Eye (6) 2·6, interorbital (5) 3·2, snout (3) 5·3, in the head.

Profiles unevenly curved, the upper steeper than the lower. Head scaly except for a small area around nostrils. Eye large, interorbital convex. Snout bluntly rounded. Nostrils small, circular, rimmed. All the opercles entire except the preopercle, whose denticulations may only be seen under a microscope. Jaws equal, premaxillaries large. An outer row of large pointed teeth in front of several series of smaller ones in each jaw. Vomer and palatines with strong teeth.

Body compressed, entirely covered with scales, which are largest on the sides, in about 25 transverse series between operculum and hypural joint; they extend on to all the fins except the ventrals. The lateral line extends to below the end of the spinous dorsal. Long axillary scales on each side of ventrals. Vent nearer anal than ventrals, with a small papilla.

Dorsal originating over ventrals and terminating well behind the vertical of the termination of the anal fin, the soft portion higher than the spinous and produced into a pointed lobe. Anal spines strong, soft portion of fin similar to that of dorsal. Pectorals, ventrals and lobes of the strongly forked caudal, pointed.

General colour, in spirit, brownish above, brown suffused with pink on the sides, and silvery beneath. A blackish stripe passes from the snout, through the eye, across the lateral line, to the ends of the anterior dorsal rays. The fins are yellowish, but the anterior rays of the anal are crossed by an irregular oblique blackish area and there is an oblique bar on the upper caudal lobe and another on the lower. The upper caudal bar extends along the caudal peduncle to the termination of the dorsal fin, the lower ceases at the first caudal spine. A black spot in the pectoral axil.

Described and figured from the holotype, 60 mm. long from the snout to the hypural joint, from Hayman Island, Queensland. Austr. Mus. regd. No. 1A.1993.

Localities.—Hayman Island, Holbourne Island and Port Denison, Queensland; collected by Mr. E. H. Rainford.

TETRADRACHMUM TRIMACULATUM (*Rüppell*).

Pomacentrus trimaculatus Rüppell, Atl. Reise Nordl. Afrika 1828-30, p. 39, pl. viii, fig. 3. Massowah, Red Sea.

Dascyllus trimaculatus Cuvier and Valenciennes, Hist. Nat. Poiss., v, 1830, p. 441.

Tetradrachmum trimaculatum Bleeker, Atl. Ichth., ix, 1877, pl. ccccix, fig. 8.

Six specimens (1A.355-360) from Holbourne Island, Queensland; coll. E. H. Rainford. New record for Australia.

TETRADRACHMUM CARNEUM (*Fischer*).

Dascyllus carneus Fischer, Jahrb. Hamb. Wiss. Anstalt., ii, 1885, p. 71, pl. ii, fig. 5. Mozambique. *Id.* Barnard, Ann. S. Afr. Mus., xxi, 2, Oct., 1927, p. 732.

This species, described as late as 1885 from Mozambique, may have been based on specimens which had straggled down from the north. Three specimens collected by the late A. R. McCulloch in 1922 on Dauco Island reef, off Port Moresby, Papua, agree very well with Fischer's description and figure. It seems remarkable, however, that the species does not appear to have been identified from intermediate localities.

DAYA FORMOSANA (*Fowler and Bean*).

Pomacentrus formosanus Fowler and Bean, Proc. U.S. Nat. Mus., lxii, 1922, p. 46, fig. 4, Takao, Formosa.

This extra-Australian species, judging from the characters given in the original description and shown in the figure, belongs to the genus *Daya*.[9]

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[9] Bleeker.—Verh. Holl. Mij. Haarlem, 1877, p. 71; type, *Pomacentrus jerdoni* Day: *fide* McCulloch, Mem. Qld. Mus. vii, 3, 1921, p. 170.

POMACENTRUS MACLEAYI, *nom. nov.*

Pomacentrus obscurus Alleyne and Macleay, Proc. Linn. Soc. N.S. Wales, i, 4, 1877, p. 343, pl. xv, fig. 2. New Guinea or Torres Strait ("Chevert"). Not *P. obscurus* Thiolliere, 1856, from Woodlark Island.

As *Pomacentrus obscurus* Alleyne and Macleay is preoccupied by Thiolliere's name,[10] I propose *Pomacentrus macleayi* as a substitute. The original description gives no definite locality, but the types in the Macleay Museum, University of Sydney, are labelled Torres Strait, which may be designated as the type locality.

POMACENTRUS INSOLITUS, *nom. nov.*

Pomacentrus analis Macleay, Proc. Linn. Soc. N. S. Wales, vii, 3, 1882, p. 364. New Guinea. Not *P. analis* Poey, 1868, from Cuba.

Pomacentrus insolitus is proposed as a substitute name for *P. analis* Macleay, *non* Poey.[11]

Family CORIDÆ.

Genus LABROIDES *Bleeker*, 1851.

Labroides Bleeker, Nat. Tijds. Ned. Ind., ii, 1851, p. 249. Haplotype, *Labroides paradiseus* Bleeker. *Id.* Bleeker, Versl. Akad. Amsterd., xiii, early 1862, p. 104 (*fide* Weber and de Beaufort, Fish. Indo-Austr. Archip., i, 1911, p. 229; reviewed by Guérin-Méneville, Rev. Mag. Zool. (2), xiv, March, 1862, p. 124). *Id.* Bleeker, Proc. Zool. Soc. Lond., 1861, pt. iii (April 7, 1862), p. 415 [8 of reprint]. *Id.* Bleeker, Atl. Ichth., i, 1862, p. 154.

Fissilabrus Kner., Sitzb. Akad. Wiss. Wien, xl, 7 (March or later), 1860, pp. 52 and 54. Haplotype, *Labrus latovittatus* Rüppell = *Labroides dimidiatus* (C. and V.).

Fissilabrus Kner, 1860, is a genus which has been overlooked by most subsequent writers and is even missed from Jordan's "Genera of Fishes." Kner recognized its identity with the prior *Labroides* Bleeker, but did not withdraw it as he considered it preferable as a name. There is, according to Agassiz, a genus of Coleoptera, *Fissilabra* Latreille, 1825, but since its etymology is apparently different, it may not preoccupy Kner's *Fissilabrus*.

LABROIDES DIMIDIATUS (*Curier and Valenciennes*).

Labrus latovittatus Rüppell, Neue Wirbelth. Abyssin, Fische, 1835, p. 7, pl. ii, fig. 2. Tor, Red Sea. Not *Labrus latovittatus* Lacépède (Hist. Nat. Poiss., iii, 1802, pp. 455 and 526, pl. xxviii, fig. 2).

[10] Thiolliere.—Ichthyologie, in Montrouzier, Essai Faun. Woodlark, 1857, p. 200, reprinted from Ann. Agric. Soc. Lyon, viii, 1856.

[11] Poey.—Repert. Fis.-nat. Cuba ii, 1868, p. 327 (*fide* Günther, Zool. Rec., 1868 (1869), p. 153), Cuba.

Cossyphus dimidiatus Cuvier and Valenciennes, Hist. Nat. Poiss., xiii, 1839, p. 136. New name for *Labrus latovittatus* Rüppell (*non* Lacépède). Tor, Red Sea.

Fissilabrus latovittatus Kner, Sitzb. Akad. Wiss. Wien, xl, 7, 1860, p. 52, pl. ii, figs. 16*a-d* (teeth and lips). Java; specimen sent by Bleeker.

Labroides latovittatus Bleeker, Atl. Ichth., i, 1862, p. 155, pl. xliv, fig. 1.

Labroides dimidiatus Günther, Fische der Südsee, vii (Journ. Mus. Godef., xv), 1881, p. 243. Not synonymy concerning *L. paradiseus* Bleeker, and not Hawaiian record. *Id.* Barnard, Ann. S. Afr. Mus., xxi, 2, 1927, p. 749.

? *Labroides bicincta* Saville-Kent, Gt. Barrier Reef, (pref. Feb. 24) 1893, p. 308, chromo-pl. xvi, fig. 4. Based on a sketch of a fish seen swimming, but not caught. Identity with *L. dimidiatus* suggested. Lady Elliot I., Queensland.

One specimen from Darnley Island, collected by Mrs. W. Miller, admits this species into the fish-fauna of Australia, unless *Labroides bicincta* Saville-Kent be regarded as a synonym. I am unable to identify *Labroides auropinna* Saville-Kent, described and figured in connection with *L. bicincta* in the same unsatisfactory manner.

HALICHORES MINIATUS (*Cuvier and Valenciennes*).

Julis miniatus Cuvier and Valenciennes, Hist. Nat. Poiss., xiii, 1839, p. 460. Java. *Ex* Kuhl and Van Hasselt, M.S.

Halichœres miniatus Bleeker, Atl. Ichth., i, 1862, p. 114, pl. xli, fig. 5.

Platyglossus miniatus Günther, Cat. Fish. Brit. Mus., iv, 1862, p. 150.

Günther (*loc. cit.*) recorded this species from "Australia. From Mr. MacGillivray's Collection," but the species has not been since noticed from our coasts. It may now be definitely listed from Queensland, however, as the Australian Museum has three specimens from the following localities: Port Denison (A. Morton, 1885), Hayman Island, Whitsunday Passage (E. H. Rainford, 1924), and Hervey Bay district (H.M.A.S. "Moresby," 1926).

Family CALLIONYMIDÆ.

SYNCHIROPUS SPLENDIDUS (*Herre*).

(Plate xvii, figs. 1, 1*a-b*.)

Gallionymus splendidus Herre, Philip. Journ. Sci., xxxii, 3, March 1927, p. 416, pl. ii. Bungau, Sulu, Philippine Islands.

D.iv/9; A.8; P.29; V.i/5; C.10.

Head (16·5 mm.) 3·8 in total length (64); depth below first dorsal (13) equal to breadth at preopercular spines (13) which is 4·1 in the length. Maximum diameter of orbit (5) equal to interocular width (5) and snout (5), 3·3 in head. Depth of caudal peduncle (8) 2 in length of caudal (16).

Head naked, broader than high and longer than broad. A pronounced nuchal depression immediately behind the upraised and prominent skinny folds surrounding the eyes. Snout tapering, its extremity blunt. Throat rounded. Opercles hidden; the preopercular spines, largely covered by skin, have each four strong hooks above and a minute spine at the tip, but are without antrorse barbs. Nostrils minute. No orbital cirrhus. Lips fleshy, the upper concealed by the overhanging preorbital. Mouth small, maxillary not extending to vertical of anterior margin of eye. Teeth minute, sharp, in bands in each jaw. Gill-opening a small aperture above the preopercular spine.

Body naked, elongate, about as broad as high anteriorly but tapering posteriorly until it becomes abruptly compressed at the caudal peduncle. Profile of back rounded, of ventral surface somewhat less so. Lateral line beginning a little before and above gill-opening and extending along the upper part of the side to the tail, following the curve of the back until it passes the second dorsal, when it curves irregularly; anteriorly it is connected with its fellow by a branch which crosses the nape just behind the nuchal depression. Genital papilla present.

First dorsal spine long and thick, the second originating close to its base. A space between the two dorsals. Soft dorsal high, the rays subequal, all branched. Anal similar to soft dorsal but with one ray less, its origin and termination behind those of the second dorsal. Pectoral very broad, rounded, much shorter than head. Ventrals broad; spines short and soft; the penultimate ray longest, extending slightly past the origin of the anal. Caudal rounded.

Colour-drawings made by the late Allan R. McCulloch and Miss Joyce K. Allan show that the ground colour is yellowish olive, becoming brownish over the anal fin, yellow on the throat and very dark bluish brown between the pectorals and ventrals. The ground colour of the anal and caudal is greyish-brown; that of the first dorsal is orange, whilst the second dorsal and the ventrals are orange proximally, shading to greyish-brown in their distal halves with a broad border of vivid blue scribbled over with irregular yellow markings. Pectorals bluish. The head, body and fins are crossed by irregular peacock-blue bands, which sometimes break up into spots, with blackish edges. Two pass through the red eye. Another passes from behind the eye on to the cheek,

where it joins a subhorizontal one crossing the snout. The most prominent markings on the body are a Y-shaped band below the first dorsal and another shaped somewhat like a mark of interrogation lying along the side and joined to a subvertical band crossing the caudal peduncle. There is a smaller U-shaped band below the soft dorsal which has one of its limbs produced on to that fin. The rest of the body bears irregular smaller bands or blotches of blue with dark edges which are almost symmetrically disposed; a band on one side being sometimes represented by two or more spots on the other. The blue markings extend on to all the fins except the pectorals. On the caudal, they take the form of attenuated bars, which tend to break up into rows of spots, between the rays which are greyish; the blue spots are found mostly on the rays of the anal and are interspersed in places by yellowish ones; the anal membrane is dusky brown. Beneath the preopercular spine there is a dark bluish area upon which are several irregular yellow streaks; one, in particular, follows a wavy course from the spine to the yellow ground colour of the throat, which latter is crossed by several thin blue bands. Between the ventrals the chest bears two brownish areas separated by a blue interspace which divides into an A-shaped form posteriorly, enclosing an unpaired brownish area just before the vent. The latter is in a blue band which connects with the lateral query-shaped mark.

In life, the ground-colour was probably more brilliantly yellow, but the description and figure here given, made from a specimen which had been fixed in weak alcohol, are as exact as circumstances permit.

Described and figured from a specimen 64 mm. long, from Hayman Island reef, Whitsunday Group, Great Barrier Reef, Queensland; collected by Mr. E. H. Rainford in 1924. Austr. Museum regd. No. 1A.2049; collector's No. 84.

Family GOBIIDÆ.

BEROWRA, *gen. nov.*

Size of adults very small. Scales large, in less than thirty transverse rows, and not extending on to nape, breast or pectoral base. Tongue not deeply notched. Upper pectoral rays neither free nor differentiated from the others.

BEROWRA LIDWILLI (*McCulloch*).

(*Gobius*) *lidwilli* McCulloch Rec. Austr. Mus., xi, 7, Feb. 20, 1917, p. 185, pl. xxxi, fig. 2, Cowan Creek, Hawkesbury River, N. S. Wales. *Idem.* McCulloch, Scient. Australian, March, 1917, p. 57. *Idem.* McCulloch and Ogilby, Rec. Austr. Mus., xii, 10, July 14, 1919, pp. 204 and 242. *Idem.* McCulloch, Austr. Zool., ii, 3, Feb. 10, 1922, p. 110, pl. xxxv, fig. 309*b*.

This interesting species, one of the smallest of vertebrate animals, is worthy of inclusion in a new genus, so I nominate it the orthotype of *Berowra*. It has been fully described and figured in the papers quoted above.

GUNNAMATTA, *gen. nov.*

Body robust anteriorly, compressed posteriorly. Head broad, depressed. Top of head and entire body excepting pectoral base covered with cycloid scales which are smallest anteriorly. Cheeks, opercles, and snout naked. Interorbital very narrow. No barbels or cirrhi. Bands of long, close-set, fixed canines in each jaw. Margin of tongue truncate. Gill-rakers short, six on the lower limb of the first gill-arch. Fins pointed. Upper pectoral rays not free. Caudal lanceolate. Six slender dorsal spines. Ventrals long, their inner rays partly united by membrane, not adnate to belly.

Orthotype.—*Gunnamatta insolita*, sp. nov.

GUNNAMATTA INSOLITA, *sp. nov.*

(Plate xvi, fig. 3.)

Br.6. D.vi/12; A.ii/8; V.i/5; P.16; C.12. Sc.40. About 15 series of scales between soft dorsal and anal fins.

Depth at first dorsal (9 mm.) 5·1 in length from upper jaw to base of caudal (46) or 6·6 in total length (60). Breadth of head (10) 1·4 in its length (14). Eye (3) less than snout (3·5). Interorbital (0·6) very narrow. Width of body (6) 1·3 in its depth.

Head broader than deep. Eyes close-set near top of head. Maxillary not reaching vertical of eye. Lower jaw slightly longer than upper. A few short mucigerous ridges on the cheeks, some pores over the opercles, and two convergent canals on each side of the occiput behind the eye. No scales on cheeks or snout; two rudimentary cycloid scales over operculum, rest of opercles scaleless. Scales on top of head behind eyes, small, crowded, cycloid, and irregularly disposed. Jaws with broad bands of long curved canines which are not depressible.

Body covered with cycloid scales which are largest on sides of caudal peduncle, and smallest as they approach the nape. Some body-scales have pyriform outlines. Muscular base of pectoral smooth.

First dorsal originating behind pectoral base, with six slender, flexible spines, of which the last is remote from the others and reaches the origin of the second dorsal when depressed. Second dorsal not so high as body, originating in advance of vertical of anal origin, its posterior rays longest. Anal similar to second

dorsal but much shorter. Caudal elongate, lanceolate. Pectorals pointed, almost reaching vertical of anal origin. Ventrals not adnate to belly, nor reaching vent, their fourth and fifth rays longest, subequal. A genital papilla.

After preservation in alcohol the ground colour is yellowish, largely covered, except on the breast, by an irregular mottling of dark brown due largely to the fuscous borders of the scales. Dark brown blotches contrast with the yellowish ground colour on the head and pectoral base as shown in the figure. Fins dark brown, excepting the ventrals and anterior anal membranes which are yellowish.

Described and figured from the unique holotype, 60 mm. in total length. Australian Museum regd. No. 1A.2517. This specimen was obtained by a Museum collecting party at Gunnamatta Bay, Port Hacking, New South Wales, where it was swimming beneath some boat-skids on 30th October, 1925.

I am unable to suggest the affinities of *Gunnamatta*, since it differs from all the gobies known to me, though it bears a superficial resemblance to *Oxyurichthys* and *Doryptena*, with which it may tentatively be grouped. Nothing resembling it appears in McCulloch and Ogilby's splendid monograph on "Some Australian Fishes of the Family Gobiidæ"[12] and Jordan and Seale's review of the Gobies of Oceania,[13] with its large key to the genera, is also unproductive of any form approaching the new genus and species.

Family CARAPIDÆ.

PIRELLINUS, *gen. nov.*

Helminthodes Gill, Proc. Acad. Nat. Sci. Philad., xvi, 4, October 25-December 12 (probably early December), 1864, p. 203, footnote. Not *Helminthodes* Marsh, November, 1864, a genus of fossil worms. Orthotype, *Oxybeles lumbricoides* Bleeker.

The generic name *Helminthodes* was introduced almost simultaneously in America for a fossil annelid by Marsh and for a fish by Gill. Marsh's paper was entitled "*Notice of a new fossil Annelid (Helminthodes antiquus), from the Lithographic Slates of Solenhofen,*" and was dated "Berlin University, July 12, 1864." It appeared in Amer. Journ. Sci. Arts (New Haven, Ct.) (2), xxxviii, No. cxiv, p. 415, as article xlii (copy in Mitchell Library, Sydney). On page 445, the date October 15, 1864, is noted, so the Journal, which has November, 1864, on its title page, was probably published about half-way through November, 1864.

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[12] McCulloch and Ogilby.—Rec. Austr. Mus. xii, 10, July 14, 1919, pp. 193-291, pls. xxxi-xxxvii, text-figs. 4-5.

[13] Jordan and Seale.—Bull. U.S. Bur. Fish. xxv, 1905 (Dec. 15, 1906), pp. 381-411, pls. xxxvi-xxxvii, lii, fig. 2, and liii, fig. 1, and text-figs. 73-96.

Gill's paper, quoted above, seems to have appeared a little later. On page 214 of the Proc. Acad. Nat. Sci. Philad., xvi, pt. 4, a notice is given of the October 25 meeting, so the part must have been published after that day. Its receipt was acknowledged by the Boston Society of Natural History on 12th December, 1864 (*fide* Fox in Nolan, Index Journ. Proc. Nat. Sci. Philad. (1812-1912), 1913, p. xiii). It thus appears that Gill's paper was not published until late November or, probably, early December, 1864.

Thus *Helminthodes* Gill (*non* Marsh) requires a new name, and *Pirellinus* is proposed as a substitute, with *Oxybeles lumbricoides* Bleeker as orthotype.

Family BLENNIIDÆ.

SALARIAS MACNEILLI, *sp. nov.*

(Plate xviii, fig. 1.)

D.xii/19; A.ii/21. P.15. V.2 + 2. C.10.

Depth at vent (8·5 mm.) 6·5 in length to hypural joint (56); head (12) 4·6 in same. Eye (2·5) 4·8 in head.

Head longer than high and higher than broad. Profile very steep, projecting slightly before the eyes. Interocular area narrow, concave. Two large occipital crests, the anterior rounded, the posterior tongue-like, a condition probably due to injury of a single crest during the life of the fish. Ocular tentacles arising from the upper margin of each eye in advance of the occipital crest, branched. A small simple tentacle arises from each anterior nostril. Nuchal groove present, but no tentacles on nape. Mouth reaching to behind eye. Anterior surface of snout wrinkled. Edge of upper lip entire, overlapping the lower lip. A continuous series of close-set incisors in each jaw. Apparently no canines. Preopercular and opercular margins hidden under skin. Opercular flap present. A row of pores along the preopercular outline, another around the eye, and scattered pores on snout.

Body elongate, compressed; belly rounded. Lateral line a series of spaced pores, curving over the pectoral fins and extending along the sides to the caudal peduncle. About thirty myocommas are visible on the otherwise smooth surface of the body. A small genital papilla.

Dorsal fin originating over operculum, markedly notched before the first ray, and terminating behind the vertical of the insertion of the last anal ray. Its last ray is joined to the body by membrane. Anal originating below posterior spines of first dorsal, with two short soft spines. The membrane is notched between the rays, but extends to form a pinnate margin on their projecting anterior

edges. Last anal ray not joined to body by membrane. Pectoral angular, lower rays thickest; the fifth lowest ray is longest but does not reach the vent. Ventrals inserted well before the first dorsal spine; each consists of two finger-like rays followed by a membrane enclosing two vestigial rays; the second thick ray is the longer and reaches about one-third of the distance from its insertion to vent. Caudal rounded; inner rays branched.

General colour, after long preservation, brownish, the body with about five pairs of smoky broad cross-bands which are not well defined and become darker on the back. There are traces of dark-edged bluish-white ocelli on the sides towards the tail. The head is uniform brownish with blue spots on the cheeks. Dorsal olive-browinsh, with a dark blotch between the first two spines, and oblique brown bars between the rays. Anal mottled smoky-brown becoming darker distally. Caudal unevenly brown, with a divided brown spot at the origin of the median rays. Pectorals light brown, with series of dark spots on the rays; the spots become blue, like those of the head, on the pectoral base. Ventrals dark brown.

Described and figured from the holotype, a specimen 65 mm. long; Australian Museum regd. No. I.14286. It was collected by Dr. A. D. C. Cummins and Staff-Paymaster P. B. Stevens, R.N., of H.M.S. "Pegasus," with five smaller ones, in the New Hebrides over ten years ago.

Named after my colleague, Mr. F. A. McNeill, whose work as joint author with the late Allan R. McCulloch on the genus *Salarias*[14] is indispensable to Australian students. There is already a species named *Salarias mccullochi*.[15]

The new species is quite distinct from all species of *Salarias* known to me, but may be remotely allied to *S. biseriatus* Cuv. and Val.

Variation.—Five paratypes from the New Hebrides each have a *single* low occipital crest, a black blotch between the first two dorsal spines, and shorter fin-rays due to their smaller size. The body-colours are contrasted more in them than in the type and there is a row of blackish blotches along the base of the dorsal fin. The anal fin is light proximally and dark distally. The caudal spot is well marked and an ill-defined smoky crescent crosses the caudal rays. Suffused dots, not definite spots, on pectoral rays. Light ocelli on body, but fewer blue spots on cheeks than in type. A specimen dissected is female. D.xii/18-20; A.ii/19-21.

Type Locality and known range.—New Hebrides.

[14] McCulloch and McNeill.—Rec. Austr. Mus. xii, 1918, pp. 9-21, pls. iii-iv.
[15] Fowler and Dean.—Proc. U.S. Nat. Mus. lxiii, 1923, p. 25.

SALARIAS MACNEILLI COLORATUS, *subsp. nov.*

Salarias, new species, Whitley, Journ. Pan-Pacif. Res. Inst. iii, 1, 1927, p. 13.

Two specimens (1A.2493, type; 2494, paratype); from Carlisle Bay, Santa Cruz Island, Melanesia, collected by Messrs. E. Le G. Troughton and A. A. Livingstone, on 20th July, 1926, are subspecifically distinct from typical *S. macneilli.* Their fin-rays are longer than those of New Hebrides specimens of the same size. D.xii-xiii/17; A.ii/20. The oblique marks on the second dorsal are few and diffuse. The whitish ocelli of the body are not dark-edged and extend on to head and pectorals. The slightly more elongate body is tan in colour, and the anal fin is much lighter than that of *S. macneilli.* Dissection shows a specimen to be a female with roe.

Range.—Santa Cruz Archipelago, Melanesia.

PETROSCIRTES GRAMMISTES (*Cuv. and Val.*).

Blennechis grammistes Cuvier and Valenciennes, Hist. Nat. Poiss., xi, 1836, p. 285. Java.

Petroskirtes anema Bleeker, Nat. Tijd. Ned. Ind., iii, 1852, p. 273. Amboina.

Petroscirtes grammistes Günther, Fische Südsee vi, 1877, p. 197, pl. cxv, fig. F (*P. anema* on plate).

Petroscirtes lineatus De Vis, Proc. Linn. Soc. N.S. Wales, ix, 1884, p. 698. Murray Island, Torres Strait.

Synonymy.—The type of *Petroscirtes lineatus* De Vis is a faded formalin specimen in the Queensland Museum, but it shows the bars characteristic of *P. anema* Bleeker = *Blennechis grammistes* Cuv. and Val. The Australian Museum has three good specimens from North-West Islet, one from Whitsunday Passage, and one from Masthead Islet, Queensland, so I have no hesitation in relegating *Petroscirtes lineatus* De Vis to the synonymy of *P. grammistes* (Cuv. and Val.).

PETROSCIRTES OBLIQUUS *Garman.*

Petroscirtes obliquus Garman, Bull. Mus. Comp. Zool., xxxix, 8, 1903, p. 237, pl. iv, fig. 3. Suva, Fiji.

This species is represented in the Australian Museum by eleven specimens from Murray Island, Torres Strait (Hedley and McCulloch, 1907) and two from the Sir Edward Pellew Group, Gulf of Carpentaria (Paradice, 1923).

New record for Australia.

Family AMPHACANTHIDÆ (*Siganidæ, auct.*).

Genus AMPHACANTHUS *Bloch and Schneider*, 1801.

"Siganus" Forskal, Descr. Anim., 1775, p. x. Haplotype, *Scarus rivulatus* Forskal (*loc. cit., nom. nud.*) = *"Scarus siganus; rivulatus"* on p. 25. A synonym of *Scarus* Forskal (part). This work is here considered non-binomial. Also spelt *Sigunus* Swainson, 1839.

"Centrogaster" Houttuyn, Actæ Harlem., xx, 2, 1782, p. 333. Type, *C. fuscescens* Houttuyn (*fide* Jordan, Gen. Fish., i, 1917, p. 44). Non-binomial (*teste* Mr. T. Iredale).

Amphacanthus Bloch and Schneider, Syst. Ichth., 1801, p. 206. Logotype, *Chætodon guttatus* Bloch. Also spelt *Amphicanthus* Swainson, 1839.

Buro Lacépède, Hist. Nat. Poiss., v, 1803, p. 421. Haplotype, *B. brunneus* Lacépède.

Buronus Rafinesque, Anal. Nat., 1815, p. 88. *Nom. nov. pro Buro* Lacépède (*fide* Jordan).

Amphiscarus Swainson, Nat. Hist. Class. Fish. Amphib. Rept., ii, 1839, pp. 172 and 227. Haplotype, *Siganus fuscus* Cuvier (*ed.* Griffith, 1834).

Teuthis Cantor (and some subsequent authors, including Günther), Journ. Asiatic. Soc. Bengal, xviii, 1850, p. 1189 (type, *Teuthis javus* Linn.). Not *Teuthis* Linnæus, *sensu stricto* (tautotype, *T. hepatus*); and not *Teuthis* Schneider, 1784, a genus of Cephalopoda.

Siganus Gill., Proc. U.S. Nat. Mus., vii, 1885, p. 280. *Ex* Forskal.

Forskal's "Descriptiones Animalium," published posthumously in 1775, is not, in my opinion, a valid systematic work. Some of the names of fishes are given in Latin in binomial or polynomial form, many are indiscriminately given vernacular names in Arabic, Greek, Hebrew, etc., and combinations of these and Latin occur. Forskal's work evidently represents an unfinished series of notes, and while due credit must be given him for his observations and discoveries, I think the progress of taxonomic work would be better helped by rejecting his names. By adopting this course, such atrocious "generic" names as *Abu-defduf* (p. 29) will be avoided.

Accordingly, I revive the straightforward generic name *Amphacanthus* Bloch and Schneider, for the genus sometimes referred to by Forskal's name, *Siganus*, and often confused with *Teuthis* Linnæus. *Teuthis* Linnæus[16] is based on two species, which are not congeneric. The first, *Teuthis hepatus*, is based on *"Browne jam.* 455, *Gron. zooph.* 353," etc. I am unable to consult

[16] Linnæus.—Syst. Nat. ed. 12, i, 1766, p. 507.

Browne's "The civil and natural history of Jamaica," the first reference quoted, but, since Linnæus appears to have derived his specific name *hepatus* from the "Hepatus mucrone reflexo" of Gronovius' Zoophylacium, I regard *Teuthis hepatus* as the virtual tautotype of *Teuthis* Linnæus. The second species, *Teuthis javus*, is an *Amphacanthus*.

AMPHACANTHUS CAPRICORNENSIS (*Whitley*).

Siganus capricornensis Whitley, Austr. Zool., iv, 4, 1926, p. 231, pl. xxxiii (not xxxiv, as stated in text). North-west Islet, Queensland. Holotype in Australian Museum.

Two specimens, 190-260 mm. long, are preserved in the "old collection" of the Queensland Museum. The larger is from Cape York and the smaller from Moreton Bay, Queensland. Mr. E. H. Rainford has collected this species from Hook Island, Whitsunday Passage, and noted the colours as follows:—"Dark brown with purplish reflections, covered with orange spots. Dorsal, anal, and caudal darker, with faint orange spots. Pectorals yellowish." Young specimens have a dark blotch on the shoulder, which is indistinguishable in the adult type.

AMPHACANTHUS LINEATUS *Cuvier and Valenciennes*.

Amphacanthus lineatus Cuvier and Valenciennes, Hist. Nat. Poiss., x, 1835, p. 310, pl. cclxxxvi. Vanicolo and New Guinea.

Teuthis lineata Günther, Cat. Fish. Brit. Mus., iii, 1861, p. 322.

Teuthis flava De Vis, Proc. Linn. Soc. N.S. Wales, ix, 1884, p. 462. No locality = Queensland. Holotype in Queensland Museum examined. *Id.* Kent, Great Barrier Reef, 1893, pp. 286 and 369.

Siganus lineatus Jordan and Seale, Bull. U.S. Bur. Fish., xxvi, 1907, p. 35. *Id.* Evermann and Seale, *ibid.* p. 98. *Id.* Ogilby, Mem. Qld. Mus., i, 1912, p. 57. *Id.* Whitley, Journ. Pan-Pacif. Res. Inst. iii, 1, 1927, p. 12.

Siganus aurolineatus Ogilby, Mem. Qld. Mus., i, 1912, p. 56. Somerset, N. Qld. Holotype in Queensland Museum examined. *Id.* McCulloch and Whitley, Mem. Qld. Mus., viii, 2, 1925, p. 161.

Siganus flavus McCulloch and Whitley, Mem. Qld. Mus., viii, 2, 1925, p. 161.

Synonymy.—The holotype of *Teuthis flava* De Vis, preserved in the Queensland Museum, Brisbane, registered No. I.11/112, is an old formalin specimen, 187 mm. long from the snout to the end of the middle caudal rays. It agrees in all details of external structure

with specimens of *Amphacanthus lineatus* Cuv. and Val. in the same institution, but the characteristic colour-markings have entirely disappeared after long preservation and most of the scales are missing. It is labelled "Coast of Queensland; *coll.* Mr. K. Broadbent." Two other specimens, 109-123 mm. long, evidently paratypes, are also preserved; the smaller of these has a markedly concave profile above the eyes, a character which disappears with age.

I have also examined the holotype of *Siganus aurolineatus* Ogilby (Queensland Museum registered No. I.449) from Somerset, North Queensland. The specimen is now almost uniformly dark brown, the fins lighter. Traces of reticulating darker lines are to be observed near the dorsal profile and a few spots remain on the caudal fin. The head (39 mm.) is 4·5 in the length to the end of the middle caudal rays (178) or 4·6 in the total length (184), not 3·7 as stated by Ogilby. The specimen agrees well with Cuvier and Valenciennes' figure although it lacks the saddle-shaped marking below the soft dorsal, and the dark lines near the dorsal profile are more densely reticulated, but a large specimen (Qld. Mus. No. I.1818) is intermediate between Ogilby's type and the original figure in these respects.

In addition to the excellent series in the Queensland Museum, I have examined eight specimens, 89-238 mm. long, in the Australian Museum, Sydney.

Localities.—Moreton Bay, Queensland (Qld. Mus. No. I.3169). "Coast of Queensland"; coll. Kendall Broadbent (Type of *Teuthis flava*). Walker's Bay, near Cooktown, N. Queensland; coll. A. R. McCulloch. Somerset, N. Queensland (Type of *Siganus aurolineatus*). Murray Island, Torres Strait; coll. C. Hedley and A. R. McCulloch, 1907. Thursday Island; coll. Donald McDonald (Qld. Mus.). Sir Edward Pellew Group, Gulf of Carpentaria; coll. Surgeon-Lieut. W. E. J. Paradice, H.M.A.S. "Geranium." Cape Wessel, Arnheim Land, Northern Territory; coll. Dr. Paradice. Vanikoro, Santa Cruz Group; coll. E. Le G. Troughton and A. A. Livingstone, 1926. Vanicolo and New Guinea (Cuvier and Valenciennes). Philippine Islands (Jordan and Seale and Evermann and Seale).

AMPHACANTHUS NEBULOSUS *Quoy and Gaimard.*

Amphacanthus nebulosus Quoy and Gaimard, Voy. Uranie, 1825, p. 369. Sydney Cove, Port Jackson.

Teuthis albopunctatus Alleyne and Macleay, Proc. Linn. Soc. N.S. Wales, i, 1877, p. 338. *Id.* Macleay, *ibid.* v, 1881, p. 443. *Id.* Saville-Kent, Great Barrier Reef, 1893, p. 286. Not *Amphacanthus albopunctatus* Schlegel, 1845.

Teuthis mixtus Saville-Kent, Prelim. Rept. Food-Fishes Qld. (Parl. Rept.), 1889, p. 10 and Great Barrier Reef, 1893, p. 369. *Nomen nudum* based on De Vis' Museum name. Chirotype in the Queensland Museum examined.

Teuthis nebulosa Günther, Fish. Zanzibar, 1866, p. 51, pl. x, fig. 3. *Id.* Saville-Kent, Prelim. Rept. Food-Fish Qld. (Parl. Rept.), 1889, p. 10, pl. viii, fig. 25.

Siganus nebulosus Stead, Ed. Fish. N.S. Wales, 1908, p. 81, pl. xlix. *Id.* McCulloch and Whitley, Mem. Qld. Mus., viii, 2, 1925, p. 161. *Id.* Barnard, Ann. S. Afr. Mus., xxi, 2, 1927, p. 785.

Siganus consobrinus Ogilby, Mem. Qld. Mus., i, 1912, p. 54, pl. xiii. Miora Banks, Moreton Bay. Cotypes in the Queensland Museum and one in the Australian Museum examined. *Id.* McCulloch and Whitley, Mem. Qld. Mus., viii, 2, 1925, p. 161.

Siganus mixtus McCulloch and Whitley, Mem. Qld. Mus., viii, 2, 1925, p. 161.

Synonymy.—I have examined a specimen of *Amphacanthus* in the Queensland Museum from Cardwell, North Queensland, regd. No. I.902, labelled "*Teuthis mixtus* De Vis, (n. nud.)." Saville-Kent published this name without any description in 1889, and it has remained a *nomen nudum* since, having therefore no status. Since, however, De Vis' chirotype is preserved, and proves referable to *Siganus nebulosus*, I regard the synonymy as worthy of note.

An examination of the types of *Siganus consobrinus* Ogilby (Qld. Mus. No. I.291) shows that they are specifically identical with specimens of *Amphacanthus nebulosus* Quoy and Gaimard from Port Jackson, New South Wales (type locality).

Localities.—Specimens labelled *S. consobrinus* are in the Queenlsand Museum from Miora Banks, Moreton Bay (types), various localities around Moreton Bay, Darnley Island and Somerset, North Queensland. The Australian Museum has specimens of *Amphacanthus nebulosus* from Port Jackson; Cape Bedford, North Queensland, and the Sir Edward Pellew Group, Gulf of Carpentaria.

Schmeltz's record of this species from Bowen[17] has been generally overlooked.

Family TEUTHIDÆ.

TEUTHIS TROUGHTONI, *sp. nov.*

(Plate xvi, fig. 1.)

Teuthis, new species, Whitley, Journ. Pan-Pacif. Res. Inst. iii, 1, 1927, p. 12.

D.ix/23; A.iii/20; P.15; V.i/5; C.16.

[17] Cat. Mus. Godef. vii, 1879, p. 49.

Depth (64 mm.) 2·3 in length to end of middle caudal rays (152). Head (40) 3·8 in same. Eye (10) 4 in head, slightly narrower than interorbital (11). Least depth of caudal peduncle (13) 11·7 in length. 6th dorsal spine (17) slightly shorter than 3rd anal spine (18). Pectoral (33) 1·2 in head.

General form elongate ovate, strongly compressed. Head scaly except around the lips. Snout twice as long as diameter of eye. Profile steeply and unevenly arched, becoming concave before the snout. Two nostrils above a short groove before the eye. Opercles entire, with a few striæ. A single row of incisors in each jaw. Each tooth is somewhat hand-shaped, with five main cusps resembling fingers; small lateral cusps are present on some teeth.

Body covered with very small ctenoid scales which extend on to the caudal fin and slightly overlie the bases of the dorsal and anal rays. The lateral line consists of a zone of punctured scales running roughly parallel with the dorsal curvature; it dips suddenly below the last dorsal rays and, after passing over the caudal spine, extends along the middle of the caudal fin. Caudal spine small, but strong. Vent situated between the posterior membranes of the ventral fins.

Dorsal continuous; the first spine is small, the others increase in size backward. Anal similar to dorsal. Pectorals and ventrals somewhat pointed; the tip of the first ventral ray reaches the base of the second anal spine. Caudal emarginate.

Colour, in spirits, greyish above and on the sides, chalky white below, the junction of the colours defined along almost all its length by an irregular dark smoky bar. Dorsal and caudal greyish with a trace of yellow. Anal greyish, except for the bases and tips of the spines and rays which are white. Ventrals white, with a blackish blotch on the rays. Pectorals yellowish. Head crossed by a stripe which passes through the eye; body crossed by four stripes arranged as shown in the figure. Another stripe extends along the front of the snout but does not reach as far as the junction of the two ocular stripes. Dark blotches occur below the pectorals and on the sides of the caudal peduncle; on one side of the type the caudal blotches have coalesced to form a short stripe on the peduncle superiorly. A dark mark on both lips, and an oblique fuscous stripe behind the ascending limb of the preoperculum.

Described and figured from the holotype, a female with minute ova. Australian Museum Registered Number 1A.2860. It was collected at Naunaha Island, Vanikoro Lagoon, Santa Cruz Group, on August 4, 1926, by Messrs. E. Le G. Troughton and A. A. Livingstone, together with a paratype. Another specimen was caught at Peu, Vanikoro by the same collectors.

Variation.—This species varies somewhat in the intensity of its colour markings, some specimens being darker than others. The

disposition of the stripes is constant, but they are thicker on the sides in some specimens. The lower spot on the caudal peduncle is absent in one specimen.

Affinities.—Near *Teuthis triostegus* (Linnæus),[18] but that species has no subhorizontal dark stripe separating the darker ground colour from the cream ventral area. Bennett's figure of *Acanthurus hirudo*[19] shows faint indications of the dividing stripes, but differs in the disposition of the body stripes. *Teuthis sandvicensis* Streets[20] has no stripe along the forehead, has only one caudal spot, and a prolonged pectoral stripe.

Localities.—Peu and Naunaha Island, Vanikoro, Santa Cruz Group, 4th August, 1926; coll. Troughton and Livingstone.

St. Crispin Reef, Outer Barrier Reef, off Port Douglas, North Queensland; coll. McCulloch.

New Guinea: Purchased from Sir Wm. Macleay.

Family LOPHIIDÆ.

Genus LOPHIOMUS *Gill*, 1883.

Lophiomus Gill, Proc. U.S. Nat. Mus., v, 1883, p. 552. Orthotype, *Lophius setigerus* Vahl. *Id.* Regan, Ann. Mag. Nat. Hist. (7), ii, 1903, pp. 279 and 282; and *ibid.* (8), ix, 1912, p. 281. *Id.* Barnard, Ann. S. Afr. Mus., xxi, 2, 1927, p. 998.

"Lophiids with vertebræ in diminished number, i.e., about 19, and toothed vomer" (Gill).

LOPHIOMUS LATICEPS (*Ogilby*).

Chirolophius laticeps Ogilby, New Fish. Qld. Coast, 20th Dec., 1910, p. 136. "Described on board the Endeavour from a unique specimen, measuring 196 millim., taken 6 miles S. 12° W. from Cape Moreton in 73 fathoms on fine sand and mud, and subsequently forwarded to the Australian Museum, Sydney." Holotype, No. E.2973, on deposit in Austr. Mus., examined.

Chirolophius? laticeps McCulloch, Biol. Res. Endeavour, ii, 3, 1914, pp. 79 and 160, pl. xxxii and text-fig. 15.

Chirolophius laticeps McCulloch and Whitley, Mem. Qld. Mus., viii, 2, 1925, p. 176.

Lophiomus laticeps Whitley, in McCulloch's Fish. N.S. Wales, ed. 2, July 14, 1927, third page of additions.

One specimen of this rare species was trawled off some rocks known as the "Toll Gates" on the New South Wales coast a few

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[18] Linnæus.—Syst. Nat. ed. 10, 1758, p. 274 (*Chætodon*). "Habitat in Indiis."
[19] Bennett.—Fish. Ceylon, 1830, p. 11, pl. xi. Ceylon.
[20] Streets.—Bull. U.S. Nat. Mus., No. 7, 1877, p. 67 (*Acanthurus triostegus* var.). Hawaiian Islands.

miles north of Montague Island, in about 40 fathoms, March, 1927, and presented to the Australian Museum by Mr. A. Ward. This species has not previously been recorded from New South Wales as it has hitherto been known only from the holotype. In his redescription of that specimen, McCulloch (*loc. cit., supra,* p. 163) stated, "It may be either a *Lophius* Linnæus or *Lophiomus* Gill, but its position must remain unsettled until another specimen can be secured of which the vertebræ can be counted."

Dissection of the New South Wales specimen shows that it has eighteen vertebræ, so that the species must be removed from *Chirolophius* and placed in *Lophiomus*. *Lophiomus laticeps* (Ogilby) is a valid species, closely allied to *L. miacanthus* Gilbert[21] from Hawaii. The two may be distinguished as follows:—

The maxillary does not reach backward to the vertical of the eyes, whose length is less than the interorbital width .... *laticeps*
Maxillary reaching vertical of front of pupil; length of orbit equal to interorbital width .... *miacanthus*

Lophiomus setigerus (*Vahl*).

Lophius setigerus Vahl, Skrivt. Naturh.-Selsk., iv, 1, 1797, p. 215, pl. iii, figs. 5-6. "Habitat in mari Chinensi."

Lophius viviparus Bloch and Schneider, Syst. Ichth., 1801, p. 142, pl. xxxii. "Habitat mare Sinense."

Mr. Tom Iredale has kindly lent me his copy of the fourth volume of the rare "Skrivter af Naturhistorie-Selskabet" (Copenhagen, 1797), in the first "Hefte" of which the descriptions of two angler-fishes (*Lophius stellatus* and *L. setigerus*) are given by Professor M. Vahl. The names of animals in this book are often arranged with the specific name preceding the generic, but they are all binomial in the Linnean sense. In view of the rarity of Vahl's paper, I take this opportunity of presenting the original description of *Lophius setigerus,* the type of *Lophiomus,* in full.

"SETIGERUS LOPHIUS depressus, capite oblongo spinis pluribus supra setis duorum parium, maxilla inferiore longiore. Tab. 3 f.5 and 6. Habitat in mari Chinensi.

CORPUS subtripollicare, cute laxa, tenui, squamis nudum. Cauda pollicaris, teretiuscula.

CAPUT magnum, sesquipollicare, oblongum, supra depresso-convexum, subtus planum, læve, inerme. Vertex fossula subpollicaris, lævis, utrinque osse elevato marginata antice angustior, apice supra maxillam superiorem in canaliculum desinens. Setæ duæ in tuberculo lineare antice in medio fossulæ: unica anterior unguicularis, tenuior, altera crassior, parum longior; duæ postice ad apicem fossulæ. *Spinulæ quinque* utrinque in margine elevato fossulæ, tres anteriores, a posterioribus parum remotæ, minores, posteriores parum majores. *Quinque* postice prope oculos tres anteriores, duæ posteriores. *Duæ* utrinque ad commissuram oris, exstanteş. *Duæ* in medio ad marginem inferiorem capitis: anterior parum inferior, major capiti parallela, antice versa; altera parum superior, minor, horizontaliter exstans. *Unica* utrinque postice, supra pinnas pectorales, reliquis parum major, tridentata.

[21] Gilbert.—Bull. U.S. Fish. Comm. (1903), pt. ii, 1905, p. 691, fig. 273. Oahu.

Rictus ore clauso oblique sursum spectans, arcuatus; aperto semihorizontalis, amplus.
Maxilla inferior oblonga, superiore longior, parum angustior. *Ossa* mobilia, subtus planiuscula, apice tuberculo minuto. *Ossicula gulæ* ut in præcedente [*i.e.* in *Lophius stellatus*].
Maxilla superior semiorbicularis, inferiore latior, apice emarginata. *Ossa* duo, anteriora mobilia.
Labia vix ulla perceptibilia.
Dentes utriusque maxillæ conferti, aciculares inæquales.
Lingua oblonga, lævis, nigra, albido maculata, apice libera. Lineæ quatuor denticulorum postice versus faucem.
Oculi in medio capitis postice sub margine fossulæ, parvi.
Apertura branchialis postice in margine sub pinnis pectoralibus, lunaris.
Anus prope caudam.
Pinna dorsalis solitaria, quinque-radiata.
Pinnæ pectorales in capite postice prope caudam more generis branchiis longiores insidentes, horizontaliter expandendæ, obovatæ, unguiculares, decem-radiatæ.
Pinnæ ventrales anteriores, lineares, angustæ, unguiculares, distantes, quinque-radiatæ.
Pinna analis in medio caudæ, dorsali opposita, quinque-radiata.
Pinna caudalis unguicularis, sexradiata."

Family TETRAODONTIDÆ.

Genus LIOSACCUS *Günther*, 1870.

Liosaccus Günther, Cat. Fish. Brit. Mus., viii, 1870, pp. 272 and 287. Logotype, *Tetrodon cutaneus* Günther.

LIOSACCUS AEROBATICUS, *sp. nov.*

(Plate xvi, fig. 2.)

D.i/8; A.ii/7; P.i/15; C.9.

Head (55 mm.) 3·2 in total length (177). Eye (11) 2·5 in interorbital width (28), and 5 in head. Distance between nostrils (11) equal to diameter of eye. Snout, measured obliquely, (29) 1·9 in head.

Profile of back gently curved; highest point over pectorals. Belly greatly distended. Normal depth probably about equal to breadth of body. Caudal peduncle tapering, broader than high. A crest over each eye is slightly higher than the broad flat interorbital. Only the lower orbital margin free. Each nasal papilla is less than half the size of the eye, is pierced by two nostrils, and rests in a depression which is deepest posteriorly. Lips thick, covered with dense papillæ like the pile of a carpet. Four teeth forming typical tetraodont jaws.

Body smooth, without keels or spines; its surface thrown into many minute folds. A few creases below the mouth and around the vent, which is large and situated just before the anal fin. Lateral line system indistinguishable except as a short streak on each side of the caudal peduncle.

Dorsal inserted far back, but entirely anterior to anal. Both these fins are small, with rounded margins. Upper and lower pectoral rays tending to form lobes. Caudal with gently rounded margin; the first and ninth rays thick and simple.

Colour, in alcohol, grey with olive-greenish tinge, becoming brownish-grey on back and over head. Nostrils, mouth, and fins yellowish.

Described and figured from the unique holotype, 177 mm. long. Austr. Mus. regd. No. 1A.408.

Locality.—Trawled off Montague Island, southern New South Wales, in 70-100 fathoms; coll. F. A. McNeill and A. A. Livingstone, Oct., 1921.

Affinities.—*Liosaccus aerobaticus* differs from *Tetrodon cutaneus* Günther,[22] from St. Helena, in having the diameter of the eye much less than the interorbital width. This species, or one very near it, has been figured as *Liosaccus cutaneus* by Fowler[23] from a specimen from the Azores which has a concave-edged caudal and only six dorsal and anal rays. *Tetrodon angusticeps* Jenyns,[24] from the Galapagos Archipelago, also has a much narrower interorbital than *Liosaccus aerobaticus.* Günther has placed *Tetraodon porphyreus* Temminck and Schlegel[25] in *Liosaccus*, but this appears to be a *Spheroides.* I have not been able to consult the description of *Liosaccus intermedius* Ribeiro,[26] from Brazil. Tanaka[27] has figured a *Liosaccus* from Japan which he identified with *Spheroides inermis* Temminck and Schlegel, but it differs in several respects from the original figure of that species.

Family SCYLLIORHINIDÆ.

PRISTIURUS (FIGARO) BOARDMANI, *subg. et sp. nov.*

(Plate xviii, fig. 3.)

Pristiurus sp. Whitley, Mid-Pacific Mag., xxxi, 6, June, 1926, p. 578. New South Wales.

A species of *Pristiurus* which appears to be new has recently been trawled in the southern waters of New South Wales. It has a well-marked colour-pattern consisting of brownish bands which cross the upper half of the body and tail and are interspersed with lighter brown areas on a light grey ground-colour. No black margins to fins. In general form and major characters, the new species, which I name *Pristiurus boardmani,* resembles *P. melastomus* (Rafinesque), the type species of the genus, with a Mediterranean specimen of which I have compared it. However, there are fewer

[22] Günther.—Cat. Fish. Brit. Mus. viii, 1870, p. 287.
[23] Fowler.—Proc. U.S. Nat. Mus. lvi, 1920, p. 206, fig. 3.
[24] Jenyns.—Zool. Voy. Beagle iii, 4, 1842, p. 154, pl. xxviii.
[25] Temminck and Schlegel.—Fauna Japonica, Poiss. 1850, p. 282, pl. cxxi, fig. 1.
[26] Ribiero.—A Lavoura, Bol. Soc. Agric. Rio de Janeiro, 1904, p. 33.
[27] Tanaka.—Fish. Japan xiv, 1913, p. 233, pl. lxvi, fig. 239.

pores on the head of *P. boardmani* than on that of *P. melastomus*, and the inside of the mouth is not so dark. The base of the anal is twice as long as that of the first dorsal, the anal fin terminating just behind the vertical of the origin of the second dorsal. In *P. melastomus*, the anal terminates just before the subcaudal fin, but in *P. boardmani*, there is a long caudal peduncle with enlarged denticles on its lower as well as its upper median surface. The important fact that there are specialized denticles between the separated anal and subcaudal fins induces me to regard *Pristiurus boardmani* as the orthotype of a new subgenus, *Figaro*.

The holotype of *Pristiurus (Figaro) boardmani* is a male, 540 mm. in total length; Australian Museum registered No. IA.2483. It was obtained by my friend and colleague Mr. William Boardman, after whom it is named, on a collecting trip aboard a trawler. Mr. Boardman subsequently collected two more males which are smaller than the holotype and show no important variation.

Localities.—10 miles N.E. of Montague Island, southern New South Wales; 70-80 fathoms, charted as "fine, sandy bottom." Trawler "Bar-ea-mul," 18th July, 1925 (Holotype).

24 miles N.N.E. of Montague Island; 90 fathoms. Trawler "Gunner," Sept., 1926 (Paratypes).

In Garman's key to the species of *Pristiurus* in his monograph of the Plagiostomia,[28] the new species comes nearest to *P. eastmani* Jordan and Snyder[29] but differs in having a more arched back, first dorsal fin inserted slightly further back, and tip of anal not reaching the vertical of the termination of the second dorsal. *P. eastmani* is the nearest ally of *P. boardmani* and evidently enters the subgenus *Figaro*.

Apart from the present novelty, only three species of *Pristiurus* appear to have been described since Garman wrote his monograph. *Pristiurus arae* Nichols[30] differs in its striking colour-markings and in having the anal fin close to the subcaudal. *P. hertwigi* Engelhardt[31] also differs in colours and proportions. I have been unable to consult the description and figures of *P. jenseni* Sæmundsson.[32]

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[28] Garman.—Mem. Mus. Comp. Zool. Harvard xxxvi, 1913, p. 91.

[29] Jordan and Snyder.—Smith, Misc. Coll. xlv, 1904, p. 230, pl. lx. Izu, Japan.

[30] Nichols.—Amer. Mus. Novitates 256, 1927, pp. 1-2, fig. 1. Florida.

[31] Engelhardt.—Zool. Anzeiger, xxxix, 1912, p 644. Yokohama.

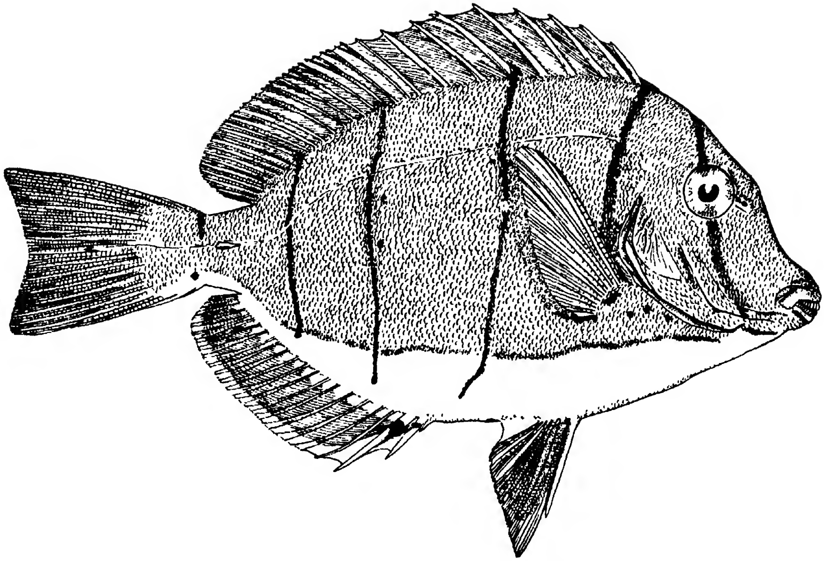
[32] Saemundsson.—Videns. Medd. nat. For. lxxiv, 1923, p. 169, pl. iv, fig. 1 and pl. v, fig. 3. Iceland (*fide* Zoological Record).

EXPLANATION OF PLATE XVI.

Fig. 1. *Teuthis troughtoni, sp. nov.* Holotype from Vanikoro, Santa Cruz Group.

Fig. 2. *Liosaccus aerobaticus, sp. nov.* Holotype from off Montague Island, New South Wales.

Fig. 3. *Gunnamatta insolita, gen. et sp. nov.* Holotype from Port Hacking, New South Wales.



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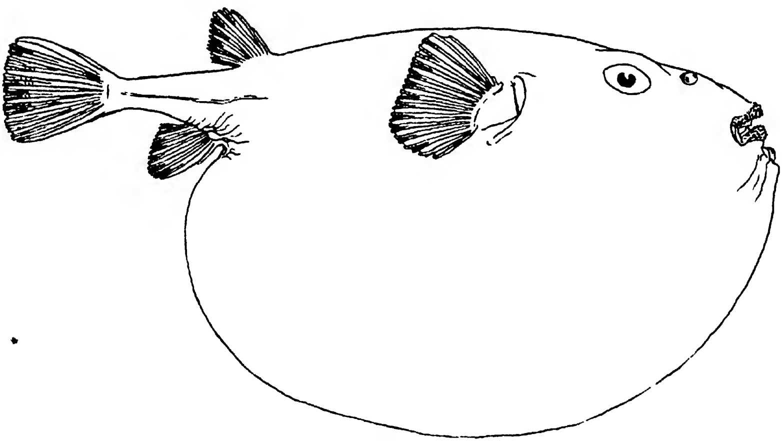

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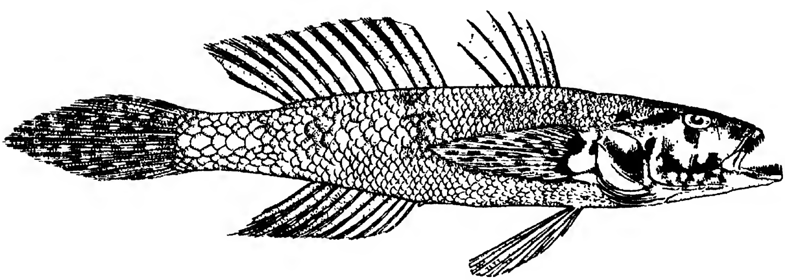

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EXPLANATION OF PLATE XVII.

Fig. 1. *Synchiropus splendidus* (Herre). A specimen from Hayman Island reef, Whitsunday Group, Queensland. 1*a*, breast of same; 1*b*, preopercular spine of same.

Fig. 2. *Amphiprion papuensis* Macleay. A young specimen from Holbourne Island, Queensland.

Fig. 3. *Tetradrachmum nitidum, sp. nov.* Holotype from Hayman Island reef, Whitsunday Group, Queensland.

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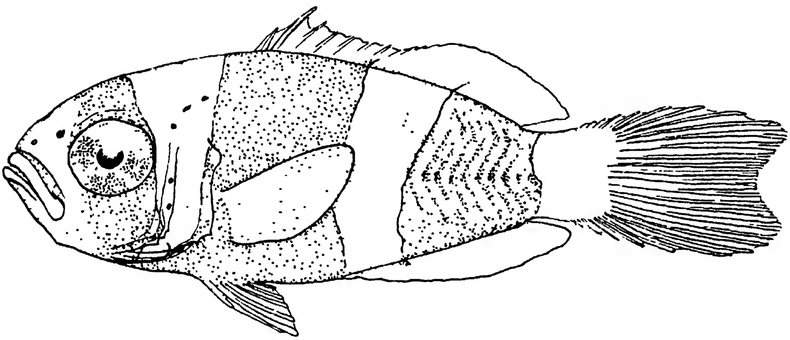

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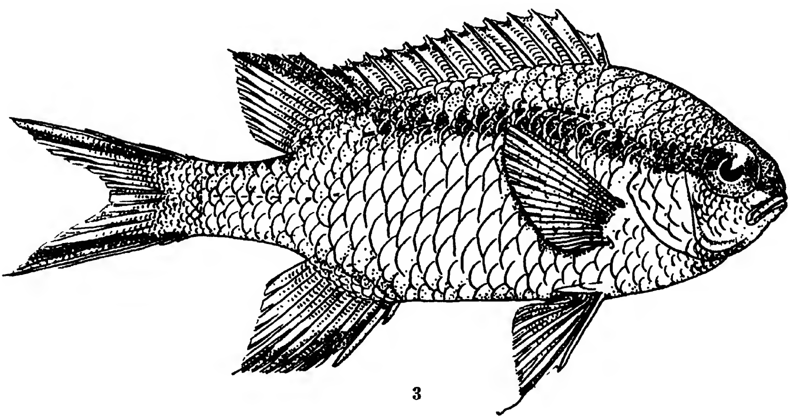

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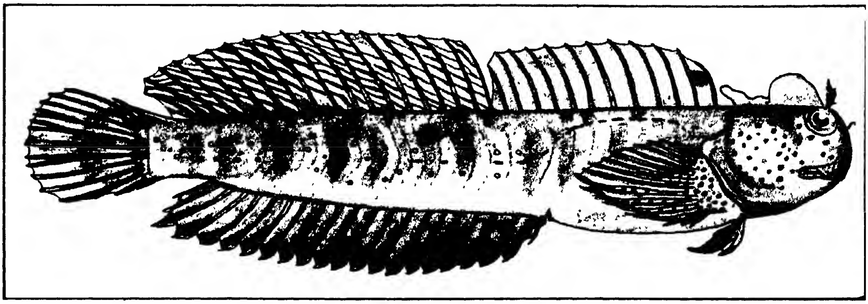
A. R. McCulloch and Joyce K. Allan (1), del.
G. P. Whitley (2 and 3), del.

EXPLANATION OF PLATE XVIII.

Fig. 1. *Salarias macneilli* Whitley, *sp. nov.* Holotype from the New Hebrides.

Fig. 2. *Tholichthys* stage of *Scatophagus.* A 12 mm. specimen from Port Denison, Queensland.

Fig. 3. *Pristiurus* (*Figaro*) *boardmani,* Whitley, *sp. nov.* Holotype from off Montague Island, New South Wales.



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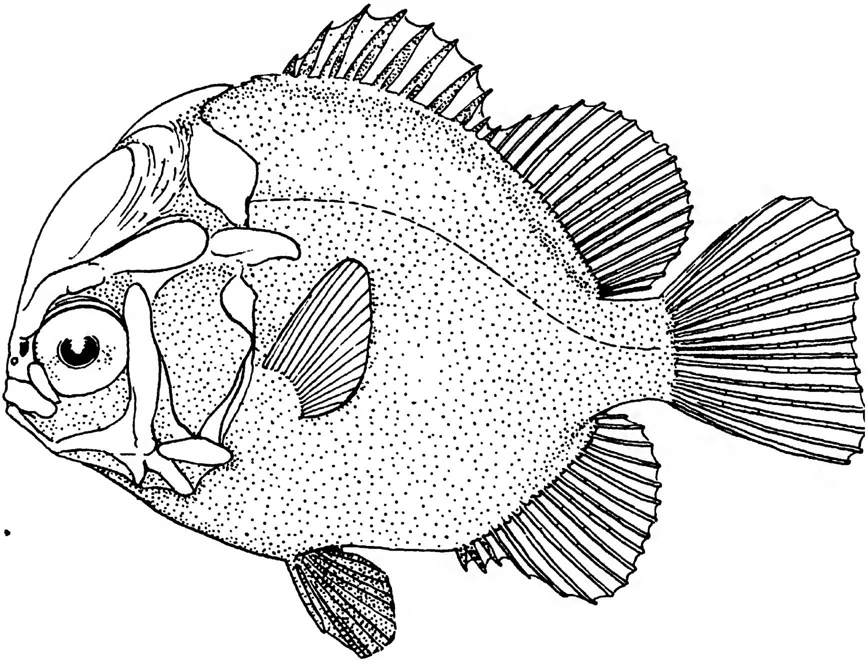

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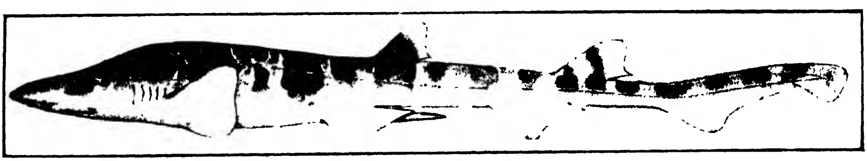

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G. P. Whitley, del.

ETHNOLOGICAL NOTES.

No. 1.

By

W. W. Thorpe, Ethnologist, Australian Museum.

(Plates xix-xxxi and one Map.)

INTRODUCTION.

The Australian Museum ethnological collections have been enriched of late years by the addition of a number of rare and interesting specimens of Australian and South Sea native handiwork. It was considered, therefore, that an illustrated description of some of the more striking pieces would form a slight contribution to the study of the material culture of these peoples.

Many of these acquisitions, particularly from the South Seas, were discovered during stocktaking, incidental to a change of ownership of a long established curio store in this city. The opportunity has been taken also to embody in these contributions, a description of other specimens, which seem to have a special interest, or are hitherto undescribed. "Ethnological Notes No. 1" will be devoted to Australian acquisitions, especially certain flaked stone implements which have been recently discovered in the Newcastle, Port Stephens, and Lake Macquarie districts.[1]

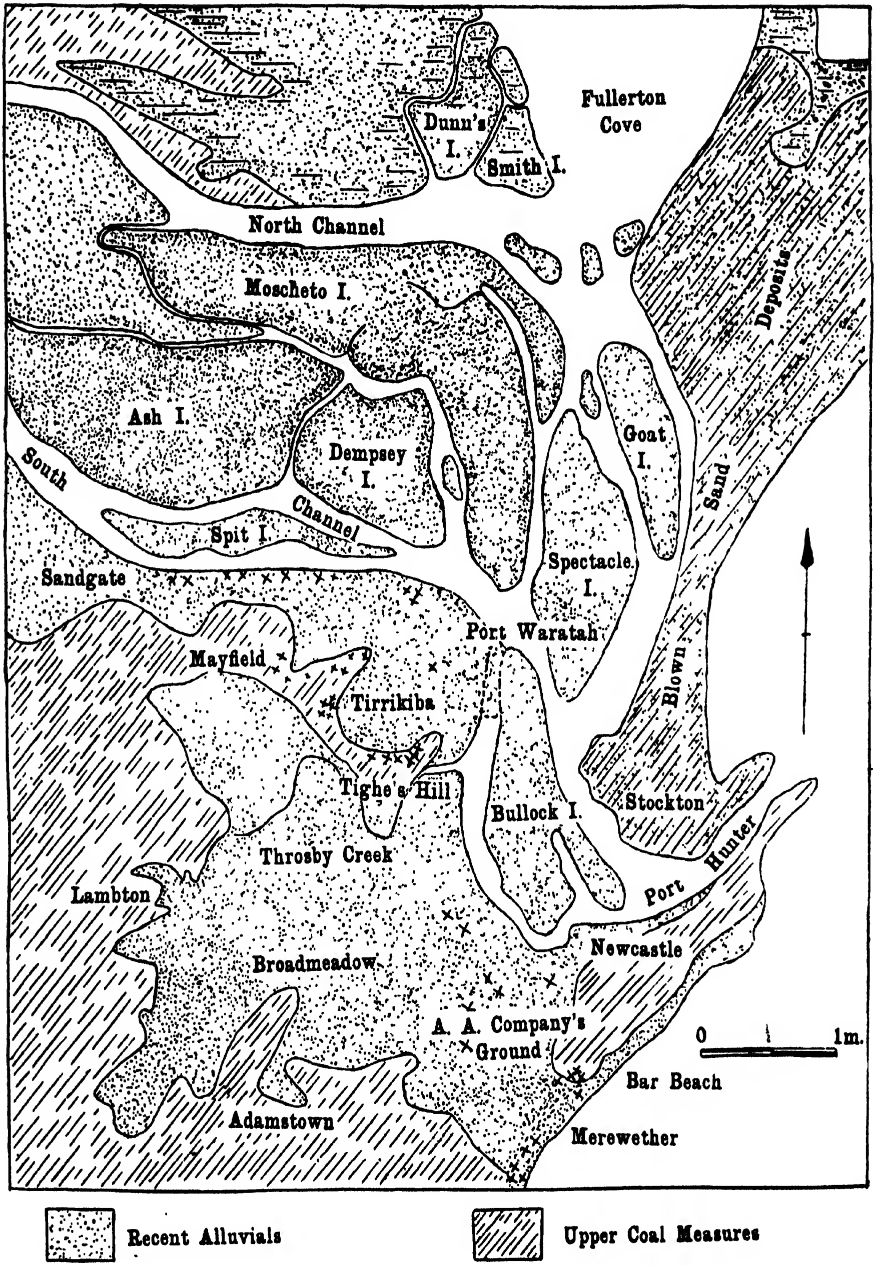
In introducing the subject of aboriginal stone implements, particularly the flaked varieties, one does so with a certain amount of caution. On the one hand the form of many has been well established; and on the other, in our present state of knowledge, it is not wise to dogmatize regarding their uses. The trained eye can readily recognize artifacts and give them tentative names, but care should be exercised when comparing aboriginal stone handiwork with old world forms. These comparisons should have no application beyond serving as a convenience; parallelism or cultural analogy should not be suggested or even implied. Moreover, the uniform behaviour of siliceous material, under percussion and pressure, gives character to flakework wherever found.

Primitive Flaked Celts.

(Plate xix.)

For miles along the bank of the south channel of the Hunter River west of the Broken Hill Proprietary's works, the shore is largely composed of midden material. To break down and

[1] First noticed by the late D. F. Cooksey, of Mayfield, who introduced the writer to the Newcastle collecting grounds and contiguous coastal "workshops."



xx Localities where aboriginal flakes have been found.

examine the contents of this area would entail enormous expense and considerable time. At intervals, however, aboriginal stone implements are revealed by tidal erosion, and other natural causes. The specimens shown in Plate xix, figs. 1 and 2, were thus obtained by the writer in the vicinity of Sandgate. Both are of grey (Merewether?) chert, and were originally large flakes produced by percussion and subsequent shaping. The larger is snub-nosed and blunt, but chipped on all edges save the proximal end. The smaller (Pl. xix, fig. 2) has the same general appearance, but differs at the distal end, where it is much thinner and narrower. The reverse sides of both show the bulb of percussion and the conchoidal fracture. The specimen illustrated in Plate xix, fig. 3, is composed of porphyry, and was found in a shell midden at Morna Point, south of Port Stephens, New South Wales. Porphyry is a local material, the headland being composed of this rock. The occurrence of two of these implements, and others which are to follow, in the middens of Morna Point, and in association with quantities of siliceous flakework, makes their authenticity as aboriginal artifacts unassailable. The reverse sides of these implements are slightly convex.

Apart from the materials used, these three figured implements have much in common, namely, the thick unchipped butts, the uniform and relative position of the bulb of percussion, and the marginal treatment shown by each. These characters favour the belief that they were all made for a similar purpose, namely, for breaking marine and estuarine shells to expose the edible molluscs.

Plate xix, fig. 4, illustrates a rather irregular and multifacetted implement from the shores of Lake Macquarie. Being composed of chert, it is also quite possible that it is an adaptation of a fortuitous block. The bruising incidental to percussion is indistinct or negligible, whereas the narrow end has been fashioned into a cutting or chopping edge. Such an implement would be useful as an "oyster stone."[2]

Chipped-back Stone Implements.

(Plates xxi-xxii, xxiv and xxv, figs. 1-4*a*).

Of the chipped-back implements described here some are intimately comparable with the productions of the Aurignacian people of the Upper Palæolithic Period in Europe.[3] The occurrence of these implements was first noticed by Mr. D. F. Cooksey, who informed the writer that those of a certain type (Plate xxiv, figs. 2-3*a*) were scattered about in moderate profusion on vacant ground, in the vicinity of the post office at Tirrikiba, a suburb of Mayfield, Newcastle, New South Wales. They were found on a bank thirty feet above the silts of the Hunter delta, which here forms a flat

[2] *Cf.* Roth.—North Queensland Ethnography, Bulletin No. 7, 1904, pl. xviii, figs. 144-149.

[3] Breuil.—Revue Anthropologique, xxi, 1, January, 1911, p. 33, fig. 4.

area about one mile wide, between the raised land at Tirrikiba and the present course of the Hunter River. As is shown on the sketch map, alluvial flats of similar character extend from Tirrikiba to Lambton and Merewether. They are low and swampy in places, covered now with fresh and brackish water, but also supporting a growth of salsolaceous herbage, which indicates the presence of salt water in the past.

In these swamps shell beds also occur but the tests are no longer inhabited by molluscs. The Tirrikiba-Tighe's Hill bank is part of the coal measure series, and here shells of the oyster, cockle, and whelk are found in association with the flakework, conclusive evidence that it was once a camp site. Other shell middens and camp sites in the district occur on the recent alluvials, and extend all along the bank of the Hunter from Port Waratah to Sandgate.

During Tertiary times the estuary of the Hunter extended as far inland as Maitland and sea water surrounded the Tirrikiba-Tighe's Hill headland. The gradual silting up of this estuary is described by Etheridge and David,[4] who also give details of raised beaches in the Maitland district. On these raised beaches no traces of man have been found, for with the combined discharge of the Hunter, Williams, and Paterson Rivers, this area became more rapidly filled with sediment. In the locality of Newcastle, however, silting took place much more slowly, and, at the time when the aborigines first settled there, the flat land at Tirrikiba was a salt-water arm of the sea, in which marine shells were abundant. The camp sites which were discovered by Mr. Cooksey along the river bank towards Sandgate, in the Australian Agricultural Company's ground, and out to Merewether (see accompanying map), are of more recent origin and belong to a period when the estuary was filled in and the river became the source of food supply. On this account the implements[5] found above the thirty feet contour line might be ascribed to comparative antiquity.

On this bank digging was extensively carried out, but without signal result. Scrapers were found in large quantities, also waste material and "cores," but there was a remarkable absence of all but four or five of the specialized form about to be described. It would appear that they were to be found only on the surface, which had been thoroughly combed by Mr. Cooksey, who possessed a remarkable series of these implements. Several of the small "la gravette" type of scarifiers,[6] or chipped-back knives were unearthed, and the estuarine shells already mentioned were scattered throughout the dark sand to a depth of four feet. The

[4] David and Etheridge.—Records of the Geological Survey, N. S. Wales, II, 2, 1890, pp. 37-52, pl. iii.
[5] See Plate xxiv, figs. 2-3*a*.
[6] *Cf.* Sollas.—Ancient Hunters and their Modern Representatives, London, 1911, fig. 116.

flaking material used at this Mayfield or Tirrikiba site was a grey chert, now organically stained, a stone which occurs *in situ* at Merewether, about three miles to the south-east.

As a rule the typical Mayfield form (Pl. xxiv, figs. 2-3*a*) differs from those from other localities in the district. They resemble more than anything else the cell of an orange, colloquially called a "quarter," though some examples are blunt at one end.[7] The largest found at Tirrikiba is in the Cooksey collection, and measures 113 × 60 × 40 mm. Those shown in Plate xxiv, figs. 1-5, are in the Australian Museum. The specimen shown in Plate xxiv, fig. 4, composed of a jasperoid rock, and probably incomplete, was found by the writer in a rock shelter near the ferry wharf, Bay Street, Lane Cove River, Port Jackson. Others of a diminutive character, but quite distinct from the slender "scarifiers" so common in the coastal dunes of New South Wales and Victoria, have been found at Garie, National Park, and deposited in the collection of the Department of Geography, University of Sydney. These two latter finds obviously extend the range of this type of chipped-back implement beyond the Newcastle district.

Other types of chipped-back implements, comparable but not identical with those described above, have been found at Merewether, Morna Point, Red Head, and Anna Bay. Altogether there appear to be four distinct varieties which are summarized as follows:—

1. Massive, and of grey chert. (*a*) From Merewether, 178 × 80 × 60 mm., and 148 × 80 × 60 mm. (Cooksey collection); 146 × 86 × 72 mm. (Department of Geography, University of Sydney) (Plate xx, figs. 1-2). (*b*) From Bar Beach, Newcastle, 150 × 75 × 52 mm. (C. W. Loch collection). (*c*) From Red Head, near Newcastle, 169 × 78 × 60 mm. (Cooksey collection).

2. Massive, crudely made of (*a*) porphyritic rock and basalt, from One Mile Beach, Anna Bay, New South Wales (Plate xxi, figs. 1-2, and Plate xxii, figs. 1-2); (*b*) of porphyry from Morna Point (Plate xx, fig. 3); (*c*) of felsite from the original land surface, back from the beach, south of the entrance to Lake Macquarie (Plate xxi, fig. 3).

3. Medium sized,[8] of grey chert and more elegant finish, from Tirrikiba and Bar Beach (Plate xxiv, figs. 1-3*a* and figs. 5 and 5*a*).

[7] An uncurved chipped-back knife "from Australia," hafted with skin and cord is figured by Evans in "Ancient Stone Implements of Great Britain," London, 1872, p. 264.

[8] *Cf.* Chatelperron (Aurignacian), Breuil.—Revue Anthropologique, xxi, 1, Jan., 1911, p. 33, fig. 4; and Sollas, *ibid.*, fig. 114.

4. A small type in chert, from Merewether, Mayfield, Red Head, and Morna Point (Plate xxv, figs 1-2*a*), resembling the "semi-circular" knives described by Horne and Aiston.[9] The small "scarifiers," comparable with the la gravette[10] form of the Aurignacian, also occurring in Egypt and Kenya, Africa,[11] and elsewhere, were found at all the sites in the Newcastle district, and in great profusion at Red Head. At the last-named site, a variety (Plate xxv, figs. 3 and 3*a*) with a slight[12] dorsal depression near the distal end, was also present in sufficient quantity to be considered a normal form.

The Anna Bay (One Mile Beach) occurrence of flaked stone implements consisted of patches in wind-swept troughs between the sand dunes situated about a furlong from the sea.

Other Flaked Implements.

Beside the massive "choppers" already referred to, other interesting forms were found. One large crescentic implement in porphyry, resembling in outline the "gigantic" form described by Horne,[13] was discovered (Plate xxii, fig 3). The writer was hesitant about accepting implements of this material, but local evidence, such as small heaps of "spawlings" where work had been carried on, covered by sand, and subsequently disclosed by the wind, was all convincing.

A triangular scraper (Plate xxiii, fig. 5), with one cutting edge, and a crudely flaked "celt" in porphyry (Plate xxiii, fig. 1) was also found. The "reverse" of this unique (?) specimen is unworked, though the "bulb of percussion" is well defined. As evidence that the local aborigines were not altogether unacquainted with ground implements, as distinct from simple flakework, a normal olivine-basalt axe (Plate xxiii, fig. 2) was found, in association with the porphyry artifacts already described.

It is obvious that where siliceous material was abundant, or available in quantity by trading, ground implements could be dispensed with. This is instanced by the profusion of chert spawlings on the camp sites south of Merewether, New South Wales, where this material could be obtained in plenty from the adjacent cliffs. This rule seems to apply generally.[14]

[9] Horne and Aiston.—Savage Life in Central Australia, London, 1924, fig. 73, opp. p. 98.

[10] *Cf.* Sollas, *ibid.* fig. 116.

[11] De Mortillet.—Revue de l'Ecole d'Anthropologie, 1896, pp. 378-405; Cowper—Man, xi, No. 1, 1911, article 5, pp. 6-13; Seligman—*loc. cit.*, xxvi, No. 8, 1926, p. 133; Etheridge and Whitelegge—Records of the Australian Museum, vi, No. 4, 1907, pp. 238-241 (see also papers quoted); Johnson—Man, 1914, article 75.

[12] Horne.—Aboriginal Stone Implements of South-Eastern Victoria, Melbourne, 1921, fig. 10.

[13] Horne.—*Loc. cit.*, fig. 27.

[14] *Cf.* Spencer.—The Arunta, London, 1927, ii, pp. 536-7.

For the most part it would appear also that the aborigines of coastal New South Wales did not flake (or quarry) their axes, and then, by attrition, provide them with a blade. The two kinds most frequently found are the flaked axe, used as such, and the river pebble of requisite shape, ground at one end to form a blade.

In former years Lake Macquarie, New South Wales, supported a large aboriginal population.[15] As a collecting ground for stone implements it is practically untouched. An effort has been made, not without success, to interest the local residents in these relics, which can be picked up on, or in the vicinity of the lake shores. Two unusual forms, *inter alia,* have come to light, namely, a triangular (Plate xxiii, fig. 3) and rectangular (Plate xxiii, fig. 4) artifact. The first named, from Speer's Point, possesses a bulbous reverse, and shows evidence of secondary treatment along the working edge. The rectangular implement, assuming it to be such, is more asymmetrical, and might be an adaptation of a fortuitous block. Its edge is also trimmed. This latter specimen is from Cockle Creek, which is likewise a lakeside locality. The Museum is indebted to the Rev. A. J. Barrett for both of these specimens, and many other examples of normal flakework, such as scrapers and knives.

On a recent visit to Lake Macquarie the writer discovered a flaked axe in the vicinity of a midden south of Croudace Bay. It is of siliceous material, one side showing the "bulb of percussion" and the conchoidal fracture. The figured side (Plate xxxi, fig. 3) is characteristically facetted.

An Incised Stone.

(Plate xxv, fig. 5.)

This curious relic is portion of a basaltic slab of some unknown form. It bears a series of crescentic markings. In outline the specimen resembles the head of the aboriginal hurling weapon in wood known as a lil-lil. The bevelled end is thinned down to what might be tentatively termed the blade. The reverse side is plain except for the incised outline resembling a human hand, *minus* the thumb. The original outline of the object in its entirety is not known. As it shows a recent clean fracture at one end, an effort was made to obtain further portions, but without result, the finder having died. It was ploughed up in orchard land at Galston, near Hornsby, New South Wales.

Dimensions.—Length 190 mm., breadth 86 mm., thickness 20 mm., weight 1 lb. 3¼ oz. Presented to the Australian Museum by Mr. L. Lawry Waterhouse.

[15] Threlkeld.—An Australian Language, Sydney, 1892.

Massive Flaked Chopper.

(Plate xxxvii, fig. 1.)

A broad-bladed implement or weapon composed of ferruginous quartzite. The shape has been attained by coarse flaking, extending almost over the entire surface. This is not represented as a unique specimen, for the writer has been informed of another example in the South Australian Museum, Adelaide. As the working edges show no sign of contact with other stones, except that which is associated with its manufacture, and as it is far too unwieldly for use as a weapon, the writer offers the suggestion that it was used for bark-stripping. Weight, 7lb. 12oz.

Found on Kallara Holding, Darling River, New South Wales, and presented to the Australian Museum by Mr. C. G. W. Officer.

Nardoo Mills of Unusual Form.

(Plate xxvi.)

These nether stones of quartzite, or desert sandstone, are quite unlike the common slab-like examples usually seen in museums. The figured specimens were found, along with eight others of similar type, in the sandhills between Lake Boolabooka and the Darling River, west of Trida, beyond Condobolin, New South Wales. Transverse and vertical dimensions are shown in the plate; weights 32¼ and 26¾ lb. respectively. Their discovery was incidental to the extension of the western railway system in 1925. They formed part of a large consignment of aboriginal seed-grinding equipment sent to the Australian Museum by Mr. V. W. Mahoney, Officer-in-charge.

Doubly-grooved Conical Implement.

(Plate xxvii, fig. 2.)

This stone object, of unusual form, having features comparable with those of the cylindro-conical stones of western New South Wales,[16] has other special characters which make it of interest. Composed of a compact igneous rock, and more or less oval in section medially, it is finished to a remarkable degree by what is usually termed "pecking." Two well defined grooves encircle it, and the pointed end, while showing no signs of wear, is regularly tapered to a symmetrical cone. Its use is conjectural. Found on the surface at Condobolin, New South Wales.

Dimensions.—Length 267 mm., diameters 82 to 98 mm., circumference 280 mm., weight 6 lb. 4 oz. Presented to the Australian Museum by Mr. C. J. McMaster, formerly Commissioner for Western Lands.

[16] Harper.—Proc. Linn. Soc. N. S. Wales, xxiii, 3, 1898, pp. 420-36; Etheridge—Memoirs Geological Survey of N. S. Wales, Ethnol. Series, No. 2, 1916; Horne and Aiston—Savage Life in Central Australia, London, 1924, pp. 164-172 (bibliography, p. 165).

Bone Implements.

(Plate xxv, fig. 4.)

This bone relic is portion of the proximal end of the right tibia of a kangaroo. The inner margin has been roughly broken, leaving the marrow channel exposed for the entire length. The lower and denser portion has been worn to a V-shape and possibly formed the working edge. As an alternative to its being a tool, it has been suggested that it was a handle or socket,[17] and the seven definite transverse grooves were cut for lashing purposes. It also bears many other ancient and irregular scars, and signs of considerable handling. The precise use of this implement, assuming it to be such, is at the best conjectural. It may have been used as a graver, or for prising open shell fish. Its association with an aboriginal midden lends itself to the latter belief. Found at a shallow depth, when removing shell and hearth refuse, on the banks of Mooney Mooney Creek, Hawkesbury River, New South Wales. Length 213 mm. Presented to the Australian Museum by Mr. Joseph Rose.

Jinkee, or Jingee.

(Plate xxx.)

One of these sacred sticks has been presented to the Museum by Mr. C. W. Horn, who supplied the information that it was obtained "about twenty years ago at Cue," Murchison district, Western Australia. It is cylindrical or cigar-shaped; of light timber resembling sandalwood, and stone-incised all over. After several attempts, a satisfactory rubbing was made (Plate xxx, fig. 2). The decorative treatment consists of a series of twelve concentric circles regularly arranged in four rows of three, each set divided from its neighbour by concurrent wavy lines. Faint pricking is discernible around the "lower" series of circles, which are separated from one another by a well defined groove. Where space allows the "upper" extremity has been similarly fluted.

In searching for similar material and data concerning these jinkees, the writer approached Mr. J. F. Connelly, of Perth, one who has travelled largely amongst the aborigines of the western State. Mr. Connelly in his helpful way submitted rubbings of several jinkees in his collection. These were obtained in the area between Mt. Margaret and north-east Kalgoorlie. The following data were also supplied: "These carved or incised magic sticks are considered to be the sole property of the Bulyoo (medicine-man), and are reputed to possess the power (magic), of locating (within or without the tribe) the evil spirit that is responsible for the troubles and visitations, real or imaginary, a native may suffer in the form of internal pains or disorders, or some such sickness. A form of massage by the Bulyoo man often sets the patient right

[17] *Cf.* Worsnop.—The Prehistoric Arts . . . of the Aborigines of Australia, Adelaide, 1897, pl. 56, fig. 4.

again." From another source[18] the following information was obtained: "In the Mt. Margaret district these jinkees are made and used by the doctors of the tribe. They are supposed to help them in diagnoses, to learn from them when a hostile party is approaching, or to stop the wind and bring rain when it is necessary. If a woman should gaze on one she will drop dead. Initiated men will gather around these sticks and speak to them with a pathos not shown at any other time."

Four different designs have so far been recognized, namely, the spiral (Plate xxxi, fig. 1), the concentric (Plate xxx), concentric "squares" (Plate xxxi, fig. 2), and the chevron.

The concentric and spiral motive is well known in Central Australia. According to a resident missionary,[19] these circles, or churingas, amongst the Arunta tribe, indicate a camp or locality. Spencer and Gillen consider that these designs have a varied interpretation, governed by the totem of the people who manufacture and use the churingas.

Both the concentric and spiral circles are elementary designs, and world-wide in their occurrence.[20]

As man usually does not go outside of nature for his ideas, the human eye would suggest the one, and a coiled snake the other. Nevertheless these simple though universal art motives could be arrived at without intention.

Aboriginal Scoops or Shovels.

(Plate xxviii, figs. 1 and 2.)

These spatulate implements, now rare, had a very restricted distribution, namely, the country in the vicinity of the western river system of New South Wales, notably the Lachlan-Darling area. They were first noticed by Sir T. L. Mitchell[21] and referred to by Worsnop.[22] Mitchell records them as being used for "digging roots and larvæ from ant-hills," but "not used on the Lachlan."

A local name for the implement was yamma, such being ascertained in 1883 by the late Robert Grant, formerly taxidermist at this Museum. They were also noticed and recorded at a later date by Mr. K. H. Bennett, who described them[23] as "wooden shovels used for unearthing the lace-lizard (*Hydrosaurus*) and other reptiles, and also for uncovering the roots of eucalyptus trees for the purpose of obtaining water from them."[24] Grant informed the

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[18] R. S. Shenk, St. Margaret Mission, Morgan, W.A.

[19] *Fide* H. J. Hillier, Lutheran Mission, 1910.

[20] Spencer and Gillen.—The Native Tribes of Central Australia, London, 1899, pp. 141-151; *cf.* Etheridge (R. Jnr.)—Records Austr. Mus., iii, 1, 1897, pp. 1-6; Rout, E.—Maori Symbolism, London, 1926, pp. 182 and 287.

[21] Mitchell, T. L.—Three Expeditions into the Interior of Eastern Australia, i, London, 1838, pp. 332-3; *loc. cit.*, ii, pp. 23 and 344.

[22] Worsnop, T.—*Ibid.*, pp. 108-9.

[23] Quoted from "Descriptive List of Australian Weapons, Implements *et cetera*, from the Darling and Lachlan Rivers, in the Australian Museum. Collected by Mr. H. K. Bennett, of Mossgiel." Government Printer, Sydney, 1897.

[24] The water-quest is described in the Proceedings of the Linnean Society of N. S. Wales, viii, 1883, p. 214.

writer that he saw an aborigine using one for removing cooked meat from the camp fire. The two shovels described are old pieces, bearing evidence in the regular pitting, so noticeable on old wooden artifacts from this region, of having been made entirely with stone tools. The Museum possesses four others, each with a tapering handle, and not crutch-headed as shown in one of those figured. One of the tapered form is figured by Edge-Partington[25] as from the Murray River.

The only aboriginal implements approaching the yamma known to the writer, are the hardwood dishes resembling the bowl of a spoon used by the natives of Western Australia[26] and elsewhere for a similar purpose.

Dimensions.—Plate xxviii, fig. 1, length 2 feet 5 inches, maximum breadth 5¾ inches, depth of bowl 1¼ inches; Plate xxviii, fig. 2, length 3 feet 6½ inches, maximum breadth 2½ inches.

Carved Lil-Lil.

(Plate xxviii, fig. 3.)

This weapon has been selected for description, firstly on account of its banner-like blade, in which it differs from those figured by Etheridge,[27] and secondly because of the fine linear carving which covers it more or less on both sides. The main design is fluctuate or serpentine, with parallel flutings in different directions filling up the interspaces, and on what might be termed the chopping edge. On the opposite side the serpentine motive is still more pronounced, though not so tortuous; and the flutings are in part somewhat curved. These weapons are sometimes carved over the entire surface.[28] No definite locality was supplied with this specimen, but it may be ascribed tentatively to the Murray River.

Length 2 feet 7¼ inches, blade 7½ inches.

Carved Boomerangs.

(Plate xxix, figs. 3 and 4.)

Boomerangs of this type have been ably described by Etheridge,[29] Roth,[30] Graebner,[31] and others, but as the two about to be noticed differ in the carved designs, it is thought advisable

[25] Edge-Partington and Heape.—Ethnographical Album of the Pacific Islands, First Series, ii, Manchester, 1890, pl. 354, No. 18.
[26] Brough Smyth.—Aborigines of Victoria, Melbourne, 1878, i, p. 341.
[27] Etheridge.—Internat. Arch. für Ethnog., x, 1, 1897, pp. 8-16.
[28] Edge Partington.—*Loc. cit.*, Third Series, 1898, pl. 102, No. 23.
[29] Etheridge.—Proc. Linn. Soc. N. S. Wales, ix, 2, 1894, pp. 193-200, pl. xv; *loc. cit.*, 1896, x, 1, pp. 14-22, pls. ii-v; *loc. cit.*, xi, 2, 1897, pp. 260-2.
[30] Roth.—Ethnological Studies, Brisbane, 1897, pp. 143-5, Sect. 241, pl. xvii, figs. 309-10.
[31] Graebner.—Globus, xc, 1906, p. 238.

to figure them. Plate xxix, fig. 3, illustrates a fine piece of aboriginal workmanship, the design consisting of a series of five triple-line rhombs, each concentrically lined with delicate and regular incisions. At the junction of each rhomb is a series of chevrons, while the outer margins of the weapon are marked with parallel flutings.

Length 2 feet 4¾ inches, greatest breadth 2¼ inches. Said to have been obtained at Gympie, Queensland.

Plate xxix, fig. 4, depicts an example finely carved down the centre with a series of conjoined ovals. In the interspaces on the margins similar elongate figures are incised. Weapons of this description are normally carved on one side only.

Length 2 feet 7¼ inches, greatest breadth 2¾ inches. From central west Queensland. Presented by Mr. William Dixson.

Carved Boomerang-like Staves.

(Plate xxix, figs. 1 and 2.)

These implements are modern, and their use, if any, can only be surmised. Their special interest lies in the art expressed upon them which is typically aboriginal. The surface of the larger (Plate xxix, fig. 2) is divisible into four zones, separated by narrow panellings of zig-zag lines. The blade on the left bears a representation of an echidna (?), and a series of five emus. On the narrow part, or "waist," of the implement are two snakes, two lizards and two plain turkeys. The right blade is ornamented with two platypuses, two emus and another small bird figure (? ibis).

The surface of the smaller implement (Plate xxix, fig. 1) is divided into three zones, with a representation of a kangaroo on each blade. Two emus and two snakes occupy the narrow part of the implement. The reverses of both pieces are plain. All the animal designs are cross-hatched and the eyes omitted. Both said to be from Gympie, Queensland. The Director of the Queensland Museum, Mr. H. A. Longman, informed the writer that examples of this modern work are represented in that institution.

Dimensions.—(Plate xxix, fig. 2) length 3 feet 4 inches, breadth 6¾ inches; (Plate xxix, fig. 1) length 2 feet 6½ inches, breadth 6¾ inches.

Shell Spoon.

(Plate xxviii, fig. 4).

This implement, or utensil, consists of a short hardwood stick roughly split at one end to accommodate an oval and concave piece of Melo shell. In general appearance it resembles aboriginal handi-

work, the wooden portion being comparable with similar handles for holding iron bits, as figured by Roth.[32] It is also possible that the Melo section served a secondary purpose, as the butt-end of the handle bears evidence of burring where it has been struck, a condition produced when the slot possibly held a metal blade.

Overall length 10½ inches. Queensland (?).

ACKNOWLEDGEMENTS.

Acknowledgement is due to the late D. F. Cooksey, of Mayfield, who originated the exploitation of the Newcastle collecting areas; to Mr. M. S. Stanley for generous field assistance; to Miss L. D. Hall, B.Sc., for the topographical and geological observations; and to Mr. S. G. Gray for the field map of this area re-drawn from Miss Hall's sketch.

[32] Roth.—North Queensland Ethnography, Bulletin, No. 7, Brisbane, 1904, Section 31, pl. xvi, figs. 128-129.

SOME ABORIGINAL FLAKES FROM MORNA POINT, NEW SOUTH WALES.

By

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(From the Department of Geography.)

(Plates xxxii-xxxviii and Figures 1-9.)

INTRODUCTION.

The paper contains a detailed description of a series of flakes and chipped implements found at a deserted aboriginal camping ground among the sand dunes of Morna Point, New South Wales. The aborigine chose to live near the sea which supplied him with food in the form of shell fish, and all along the coast, in places suitably sheltered, regions of kitchen midden material are to be found. A search among these heaps will reveal very few native weapons such as spears and boomerangs, for these were carried by the hunter wherever he went and were left distributed over wide areas. Segregated artefacts are limited to these small sharp-edged chips of chert or other hard stone, which were struck off from a suitable pebble in hundreds, used indiscriminately for all manner of domestic purposes and then discarded. These chips occur in mounds associated with the shell middens and constitute the typical "workshop" material as described by Etheridge and Whitelegge.[1] In their paper chips from workshops along the coast near Sydney are described in detail, but other than this comparatively little work has been done on these small flaked artefacts in New South Wales. Roth[2] gives a complete description of the method of stone flaking and the various uses to which flakes are applied by the Queensland aborigines. Basedow[3] has also a comprehensive article on stone implements used by the blacks of central and northern Australia. He describes the method of chipping flakes from an original core or nucleus and discusses the uses for which the various types were made. He also describes the methods of flaking by percussion and chipping by pressure.

The use of stone knives and flakes by the natives of central Australia together with descriptions of various tools are given by Horn and Aiston,[4] and also by Spencer and Gillen,[5] from whose

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* At the time of writing this paper Miss Hall was a Science Research Scholar in Geography to the University of Sydney.

[1] Etheridge and Whitelegge.—Rec. Austr. Mus., vi, 4, 1907, pp. 233-250.

[2] Roth.—North Queensland Ethnography, Bull. 7, 1904.

[3] Basedow.—The Australian Aboriginal. Adelaide, 1925.

[4] Horne and Aiston.—Savage Life in Central Australia. London, 1924.

[5] Spencer and Gillen.—The Native Tribes of Central Australia. London, 1899.

work the following extract is taken: "Sometimes by the side of a waterhole or on the top of a hill where the suitable material exists there will be found numbers of these rude chips which are made as occasion requires and only the better ones among which are kept for use in the making of the cutting surface of the adze or spear thrower." Klaatsch,[6] 1908, has written an article on the stone artefacts of Australia and Tasmania, while Eylmann[7] also describes stone flaked implements. Brough-Smyth[8] describes stone implements used by the natives of Victoria and divides them into eleven groups, while a detailed classification, based on modes of preparation and manufacture, is given by Kenyon and Stirling.[9] The first big division of this classification includes the tools collected from Morna Point as they are all "cutting implements in which the edge is produced by flaking or chipping." Flakes and their uses are mentioned incidentally to the culture of the aborigines in a number of volumes and articles, but much more attention has been paid to descriptions of larger weapons than to the small knives and scrapers used in their making.

In conclusion I wish to acknowledge the kindness of the Trustees of the Australian Museum in placing facilities at my disposal during the preparation of this paper; and also to express my grateful thanks to Mr. Thorpe, ethnologist to that institution, who not only introduced me to the collecting grounds at Morna Point, but also assisted me greatly by helpful suggestions and information concerning references.

GEOLOGY AND PHYSIOGRAPHY OF MORNA POINT.

Morna Point is a rocky headland immediately to the south of Port Stephens and approximately twenty miles north of Newcastle. It is interesting to note that this locality was mentioned by Mr. Whitelegge as early as 1907 as being a likely place for the discovery of aboriginal workshops, although his own researches in the vicinity of Newcastle were unproductive. As is shown on the map (Figure 1), the land is in the form of a peninsula with the waters of Tilligery Creek, Port Stephens and the ocean surrounding it on three sides. Across the peninsula are two bars of resistant porphyry separated by a band of weaker material. These bars stand out as rugged headlands, while the weaker area has been eroded to form the inlet of Anna Bay, which gives its name to the surrounding farming district. To the south is a long expanse of beach which extends from Stockton northwards in a line of sand dunes, to where it terminates abruptly in the intrusive rocks of Morna Point.

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[6] Klaatsch.—Zeitschr für Ethnologie, xi, 1908, pp. 407-427.
[7] Eylmann.—Die Eingeborenen d. Colonie Südaustralien. Berlin, 1908.
[8] Brough Smyth.—The Aborigines of Victoria, i. London, 1878.
[9] Kenyon and Stirling.—Proc. R. Soc. Vict., xiii, 2, 1901, pp. 191-197.

The locality is of considerable geological interest and has been described by David,[10] in the following terms: "At Anna Bay the sea cliffs are formed of a reddish-grey quartz and felspar porphyry the exact relations of which, in the Carboniferous system, are not clear. It has been assumed that this rock is in the nature of a contemporaneous lava; it is intersected in places by basalt dykes

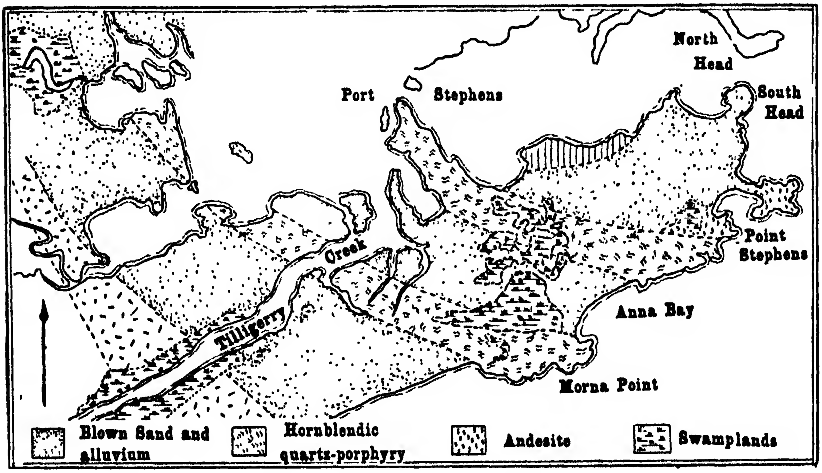


Fig. 1.—Geological Map of the Southern Headland of Port Stephens. (After David.)

of later origin. The nature of its junction with the Carboniferous rocks is for the most part obscured from view, as blown sand completely covers the older rocks over almost the entire area from Morna Point to Newcastle." A great deal of the porphyry right on the point is covered by the blown sand which forms a row of dunes along the beach, gradually passing, on the leeward side, into low-lying swampy areas subject to inundations by the waters of Tilligerry Creek. A similar physiographic arrangement persists right from Stockton to Anna Bay, where the road passes over flat alluvial areas of recent origin, with the waters of the creek on one side and separated from the sea on the other by the line of sand dunes. The swampy character of this area is due to the fact that during Tertiary times it was under water and formed part of the estuary of the Hunter River. Since that time much of the land has been reclaimed by silting associated with a recent minor uplift of fifteen feet.

The headland of Morna Point faces due south and has been attacked by marine erosion until it is now in the form of two

[10] David.—The Geology of the Hunter River Coal Measures.—Mem. Geol. Surv. N. S. Wales, Geol. No. 4, pt. 1, 1907.

rocky promontories divided by a small sandy beach, a quarter of a mile long, strewn with agglomerations of porphyritic boulders (Plate xxxii, fig. 1). The beach is quite narrow and quickly gives place to the sand dunes, from thirty to fifty feet high, which shelter it from behind. This secluded area has been, in the past, a favourite camping ground for aboriginal people. Along the sand are middens and conical shell heaps (Plate xxxii, figs. 2 and 3), reduced by the erosion of southerly storms, but still large enough to indicate how much more extensive they must have been in earlier days.

THE ABORIGINES OF MORNA POINT.

The groups of blacks who camped in this locality belonged to the Kuring-gai tribe who are described by Fraser[11] as occupying the whole coastal district from Bulli to Port Macquarie. This large tribe was divided into a number of tribules whose distribution is given by Howitt.[12] Those blacks living in the district round Dungog and Port Stephens were known as Gringai and occupied that area in a series of local groups or "Nurras." Enright[13] gives the name "Warrimee" to the group who lived all along the peninsula from Port Stephens to the Hunter River but he has since modified this statement as follows: "The Kuttung tribe occupied the country from a little south of the Macleay to the Hunter River and possibly to the Hawkesbury."

Nothing much concerning the habits and customs of these people can be told from their deserted camping ground. The heaps of broken shells along the beach show that shell fish must have been one of their chief articles of diet, but opossums, kangaroos and other animals, as well as vegetable foods, must have been obtained from the sheltered timbered region on the leeward side of the dunes. Their burial place is located on the higher ground near the southern promontory in a trough between two dunes, where pieces of skeletons and individual bones are still to be seen scattered over the surface. Here large numbers of blacks were buried in the past, but they have since been uncovered by the action of the wind. Exposed skeletons have been removed from time to time from this spot, and extensive digging operations carried on in June, 1926, failed to reveal more than two skeletons and three skulls, now in the possession of the Australian Museum. One of these skeletons was that of an old man who had evidently been buried for a long time. The body was laid quite straight with the head pointing out to sea, which in this case is due south. The arms were placed full length down, and on top of the body. Nothing else was found in the grave except the hand axe (Plate xxxvii, specimen W_1), which had evidently been the property of the

[11] Fraser.—The Aborigines of New South Wales. Sydney, 1892.
[12] Howitt.—The Native Tribes of South East Australia. London, 1904.
[13] Enright.—Jour. R. Soc. N. S. Wales, xxxiv, 1900, pp. 103-118.

man when he was alive. The bones were soft and friable and some difficulty was experienced in securing them intact. All the skeletons had been buried in deposits of recent sand, which covered a darker and much harder layer composed of sand and a substance not unlike peat. This carbonaceous material, which is now exposed in places, was probably formed by the debris from camp fires built during an earlier period, when sea-level was about fifteen feet higher than the present day.

The culture of these people, as shown by the artefacts found, would seem to have been of the most primitive type. Tools were made by flaking and none show evidence of grinding or polishing. It would therefore seem that they belonged to a standard of culture comparable with the Palaeolithic in Europe, but this cannot be stated definitely, as in Australia ground and polished implements have been found side by side with flaked ones. The difference is due to variety in the available material and its adaptability to certain methods of treatment rather than to other causes. "It is the constant mixture of implements usually regarded as belonging to different levels of culture that forms the most striking feature of the present stone age in Australia."[14]

Flakes of all sizes were obtained in abundance from a certain restricted area on the high land behind the promontory (see Plate xxxii, fig. 4). This sandy hill is a typical aboriginal workshop strewn with shells and innumerable flakes of chert intermingled with cores and "spoils" and a certain number of more carefully formed implements. Chips were also found in association with the middens on this beach (see Plate xxxii, figs. 2 and 3). From this one area nearly all the specimens described below were collected, a new series being displayed after every wind storm. A few chips were found at the very northern end of Stockton beach in association with aboriginal ovens. These ovens are now represented by rings of stones and small heaps of broken *Donax* or "pipi" shells, but they indicate positions where the natives built their fires to cook their shell-fish. All round the rocky headlands of Morna Point broken shells point to the existence of middens now almost completely covered with grass.

GENERAL DESCRIPTION OF THE ARTEFACTS.

The stone implements collected may be conveniently divided into three groups of which the first is by far the largest. All the specimens in this group are formed of fine-grained chert, mostly light grey in colour. They are all fragments which have been broken off a larger piece of rock, the central portion of which was discarded as useless. Quite a number of such cores were found associated with the flakes. The fragments were of every

[14] Spencer.—Australian Encyclopædia. Sydney, i, 1925, p. 32.

conceivable size and shape but those chosen for description have a definite cutting edge serrated by use, or else an edge has been formed by secondary chipping. Such retrimming was common and was observed to occur on flakes which were otherwise quite crudely formed. This is probably due to the fact that the natives had to obtain the chert by barter from the Newcastle blacks, and so had to use it economically. Each flake had to be examined before being discarded and as many as possible were brought into service. These treated flakes vary greatly in size and show no definite form, so they do not seem to have been made with any precise object other than the general purposes of cutting, scraping, and skinning, for which a sharp-edged tool was needed. Among these indiscriminate flakes, however, were found other more specialised types which had been fashioned along definite lines. These have been made gradually by modifications of the more primitive forms, and in the following description the simpler types are treated first in order to bring out this line of evolution.

In the second group the implements are much larger and have been made from the igneous rock of the headland. They were at first overlooked and considered to be natural boulders and weathered fragments. Closer examination showed that they were stone implements roughly shaped into a definite form by the removal of flakes. Some of these crude hand axes and choppers are made of andesite, which must have been obtained from a locality farther to the north. (See map, fig. 1).

The third group is represented by one specimen alone, which is not composed either of chert or igneous rock. This implement (Specimen Z, Pl. xxxviii) is a small piece of fine-grained sandstone, cylindro-conical in shape and truncated at one end. Its definite form and association with the other flakes on the workshop prove it to be an artefact probably derived from a neighbouring locality. Its purpose is not quite clear, but it may have been used as a rasp or burnisher for the finishing and smoothing of the spears.

The terms used in describing the flakes are taken from Roth,[15] and are applied in the same sense. The "upper" surface of a flake is the last removed surface, and therefore the one which shows the bulb of percussion. The "lower" surface shows the facets due to other flakes which were previously removed from the core. The "slope surface" marks the position where the blow was struck which caused the flake to break away. The term "flaking" is applied when the pieces have been removed by percussion, while "chipping" is used to express the finer results obtained by pressure. Of the specimens described some are in the Australian Museum collection while the rest are the property of the Department of Geography, Sydney University.

[15] Roth.—North Queensland Ethnography, Bull. 7, 1904.

DETAILED DESCRIPTION OF THE ARTEFACTS.

CORES.

These have been collected because of their interesting relationship to the formation of the flakes and not because they are important as implements. In most cases they were discarded as useless, although some show signs of having served a purpose. Hence the following classification.

A. *Useless Cores.*

Plate xxxiii, figs. A_1.—A small rounded specimen, which is a remnant of a chert nodule. On one side it is smooth and composed of the original weathered outer surface, while on the other it is facetted by a series of clean fractures where flakes have been broken off. It is a simple core discarded after the desired number of flakes were obtained from it.

Plate xxxiii, figs. A_2.—A specimen very similar to the one above, except that chips have been flaked from all sides and no portion of the original surface remains. It is fairly small, has many angular facets and shows bruising due to the blows by which the flakes were removed.

Plate xxxiii, figs. A_3.—This core is flatter and of somewhat different shape, but this modification is due only to the manner in which the flakes have been removed. It has been treated on all sides, and has, therefore, a rugged and facetted appearance.

B. *Useful Cores.*

Plate xxxiii, figs. B_1.—A flatter type of core, fairly large in size and definitely rounded in shape. Flakes have been struck off from both sides, which are ridged and facetted. Secondary retouching has been carried out along two sides to produce an irregular sharp edge similar to that of the implement described as a "choppee" by Horne and Aiston.[16]

Plate xxxiii, figs. B_2.—A large thick specimen in which flakes have been removed from all sides except one, where the original weathered surface is still visible. The core is roughly wedge-shaped and at the narrower end secondary flaking has produced a blunted area, which may have been used for chopping or pounding. At the opposite end the sharpness of the ridges is also modified by bruising. This may have been done in order to give the core a more comfortable feeling when held in the hand.

C. *High-crowned Scrapers* (Figure 2).

These are simply useful cores modified into a more regular shape. The under surface is simple and smooth and thus forms

[16] Horne and Aiston.—*Loc. cit.*, p.

a base for the upper facetted portion of the core, which is usually thick and high.

Plate xxxiii, figs. C_1.—A fairly large specimen, oblong in shape. The upper surface is high and divided into innumerable facets. Where the upper surface joins the simple base is a good cutting edge which has been treated all round with secondary chipping. This formation of a definite edge indicates its use for some scraping purpose.

Plate xxxiii, figs. C_2.—A smaller, more irregular type, showing part of an original weathered surface on the upper side. The remainder of the upper surface is divided into a number of small facets. The lower surface was at first simple, but has been broken by secondary flaking. The scraping edge is marked by a line of chipping.

Plate xxxiii, figs. C_3.—A small type in which the base is slightly concave and shows a small bulb of percussion. Otherwise it is similar to the others described above, with a high upper surface broken into small facets and an irregularly shaped cutting edge marked by secondary chipping.

Plate xxxiii, figs. C_4.—A type also showing a concave base similar to the one above. The upper surface is very high and divided into three main facets by ridges which come to a point at the top. The secondary chipping along the cutting edge is very small.

Flakes with Secondary Chipping (Figure 3).

These mark a further stage in the development of useful tools. The form is still crude and irregular, but in each case secondary treatment along one or more edges shows they have been used for some purpose. The shape of a given flake is quite accidental, being mainly due to the nature of the original core and its response to percussion. This natural shape is sometimes important in determining the usefulness of the flake, but it cannot be considered as any basis for a fixed classification. In the following list of flakes and scrapers, however, it has been found convenient, for purposes of description, to place them in groups showing similarity of shape, as they are not definite tools which can be classed according to use. These flakes represent the most primitive type of implement and are comparable to the Chellean culture of Europe as described by Sollas.[17]

D. *Large Flakes.*

Plate xxxiii, figs. D_1.—A large, elongated, slightly curved flake, with simple upper surface showing bulb of percussion and a distinct

[17] Sollas.—Ancient Hunters. London, 1911.

slope surface at one of the narrower sides. The side opposite the bulb of percussion is also blunt and has a small facet similar to the slope surface. The lower face of the flake has three facets and is divided into two major portions by a longitudinal ridge. The two long sides of the flake are curved, one slightly concave and the other slightly convex. Both of these have been extensively chipped to form a good scraping edge.

Plate xxxiii, figs. D_2.—A thicker, three-sided flake, roughly triangular in cross-section at the wider end, where it appears to have been broken. The other end tapers in to a distinct, though blunted, point. The upper surface is simple and slightly convex. The lower surface is also simple but has been treated by secondary flaking as well as chipping along the cutting edge. The third side has been blunted by flaking and forms a wide ridge between the other two surfaces. The flake appears to be a partially moulded chipped-back knife, broken in the process of formation and then used as a scraper.

Plate xxxiii, figs. D_3.—A crudely formed flake with a slightly convex upper surface and a lower surface deeply facetted. It has been evenly and finely chipped to form two cutting edges, one of which is distinctly concave, the other is flaked to give an irregular line after the manner of the "choppee."

E. *Elongated Flakes.*

Plate xxxiii, figs. E_1.—An elongated flake truncated at the top by a clean fracture, and tapering at the base in a distinct point. The upper surface is smooth, while the lower surface is divided into two main facets by a longitudinal ridge. One side of the flake is thick and has been blunted by secondary flaking. On the other side the edge is thin and carefully chipped.

Plate xxxiii, figs. E_2.—A smaller flake roughly rectangular in shape with both upper and lower surfaces divided into a number of small facets. Chipping has been done on all sides, but most extensively at the two narrower edges. At the lower end, secondary flaking and chipping have produced a blunted chisel point.

Plate xxxiii, figs. E_3.—A typical elongated flake showing a simple upper surface and a two-facetted lower surface with a longitudinal ridge. The top is blunted by a slope surface, part of the exterior of the original core. At the lower end the flake is obtusely pointed. Both long sides have a slightly wavy appearance due to flaking, and have been carefully retouched.

Plate xxxiii, figs. E_4.—Another elongated type broader at the top but gradually tapering down to a point. The smooth slightly convex upper surface shows no bulb of percussion. The lower surface is divided into three triangular facets which come to a

point near the centre of the flake. On one side the edge has been left untouched but the other is trimmed by flaking and chipping.

Plate xxxiii, figs. E_5.—A more rounded type but still showing the broad apex tapering to a point at the base. It is facetted on both surfaces and has chipping all round the edges. At the broader end this chipping has been done to give a smoother and firmer grip for the fingers; nearer the point the edges are thinner.

F. *Chisel-pointed Flakes; that is, flakes which have a broad straight edge prepared for use by flaking.*

Plate xxxiii, figs. F_1.—A very crude flake roughly rectangular in shape with simple upper surface and facetted lower surface. It has been chipped on all edges, but the one used for cutting is straight and marked by fine even flaking which gives it a serrated appearance.

Plate xxxiii, figs. F_2.—A similar irregular flake. The upper surface is flat and simple, but the lower surface is raised and divided into innumerable small facets. Fine secondary chipping has been carried out along the edges where the two surfaces join. On one side this prepared portion gives a smooth rest for the fingers and on the other forms the useful edge.

Plate xxxiii, figs. F_3.—A smaller and flatter piece, facetted and flaked on both surfaces and with the cutting edge marked by secondary chipping.

Plate xxxiii, figs. F_4.—A large flat flake also facetted on both surfaces. It has no distinct bulb of percussion or slope surface. It is roughly rectangular in shape with flaking on three sides, but with chipping confined to the straight useful edge.

G. *Rounded Flakes.*

Plate xxxiv, figs. G_1.— A rounded flake with a smooth convex upper surface showing a bulb of percussion. It has been flaked away on one side in order to form a thin edge at its junction with the lower surface. This latter is slightly concave and is flaked along the opposite side for the same purpose. At the upper end near the bulb of percussion secondary flaking has produced a wide ridge separating the two surfaces. The cutting edge is irregular with fine serrations and chipping.

Plate xxxiv, figs. G_2.—A similarly formed flake showing one convex and one concave surface divided by a flaked ridge along the back near the bulb of percussion. The lower surface is flaked down on three sides to form a sharp junction with the upper surface This edge is flaked and finely chipped.

Plate xxxiv, figs. G_3.—In this flake the ridge along the back has been left rough and untrimmed and the upper surface, there-

fore, appears to be divided into two facets. The distinct bulb of percussion indicates that this is not the case. The lower surface is simple and slightly concave. The straight cutting edge has been carefully retrimmed by flaking and chipping.

Scrapers.

These are irregular flakes of various sizes very similar to those already described, except that in the scraper the sharp cutting edge is usually formed in the process of flaking, and secondary chipping is not required (Figure 4). These pieces of chert with sharp cutting edges were found all over the workshop area. Many had no doubt been discarded as valueless, but others show definite signs of use. Some chips are much too small to be used as hand scrapers. Only the larger ones are dealt with below, and these are again classed according to shape as this is the most convenient method of grouping for descriptive purposes.

H. *Deltoid Scrapers.*

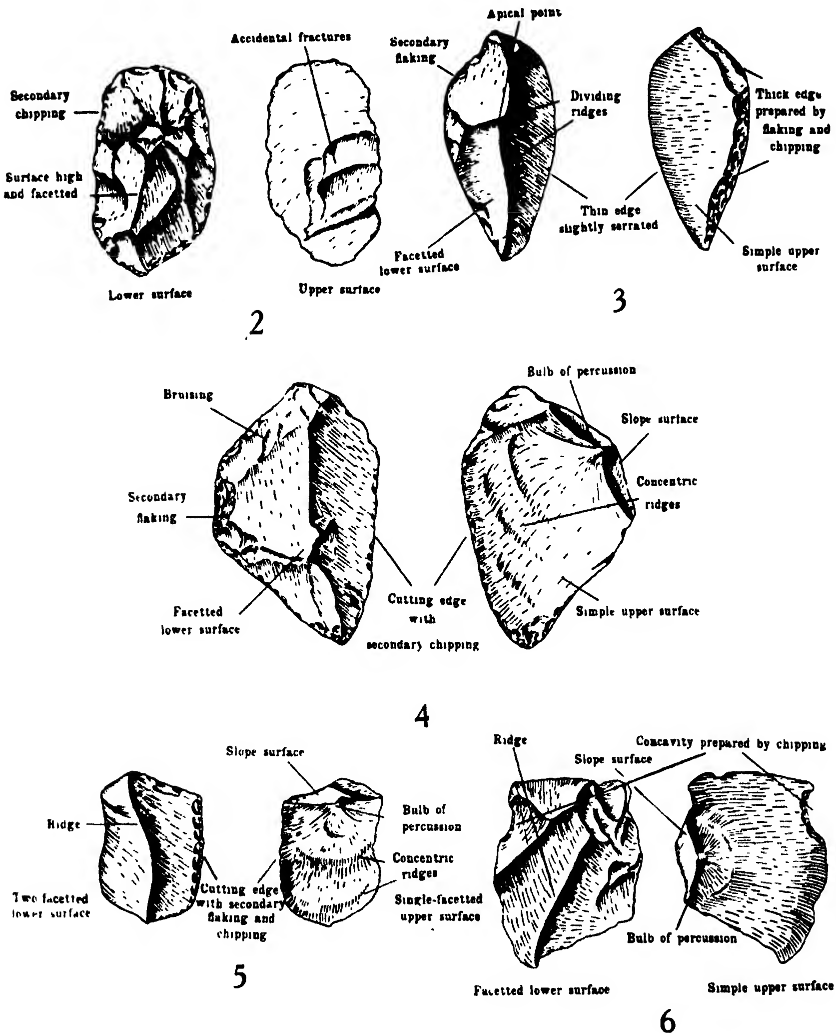
Plate xxxiv, figs. H_1.—A large deltoid scraper in which the upper surface is simple and shows a prominent bulb of percussion. The lower surface is divided by ridges into three main facets. The slope surface has been broken and bruised by blows given before the flake was successfully removed from the core. This slope surface forms the thicker part of the scraper and provides the necessary grip. The cutting edge, serrated by use, is in the normal position opposite the bulb of percussion.

Plate xxxiv, figs. H_2.—Though smaller, this scraper is similar to H_1 both in shape and general features. The bulb of percussion is prominent on the smooth upper surface. The lower surface has two main facets, divided by a distinct curved ridge and four smaller faces formed by flaking. The slope surface has been irregularly flaked by blows given previously to its removal. The left hand edge is as sharp for scraping as the normal cutting edge opposite the bulb of percussion.

I. *Scrapers intermediate in shape between the elongated and rounded types.*

Plate xxxiv, figs. I_1.—A thinner flake, somewhat elongated in shape, yet with its end more rounded than those above. It has no main ridge, but the lower surface is divided into facets by six short ridges, four of which meet at a point near the centre of the flake. The upper surface is marked by lines concentric with the bulb of percussion. The slope surface is small. The extent of the cutting edge is indicated by the small serrations which occur on three sides of the flake.

Plate xxxiv, figs. I_2.—This flake is also thin, but it has not the elongated point and thus more nearly approaches the rounded or polygonal type. On the upper surface the bulb of percussion has been broken by flaking. The slope surface, though distinct, is fairly small, and has been bruised in the production of the flake. The lower surface has four facets. The normal cutting edge opposite



FIGURES 2–6.

2. A typical high-crowned scraper. 3. A primitive flake showing secondary chipping. 4. A simple scraper showing the typical method of formation. 5. A scraper with trigonal formation. 6. A typical "spokeshave" scraper.

the bulb of percussion has been spoilt by the nature of the conchoidal fracture. It is, therefore, the thin edges on either side of this one which have been used for scraping.

J. *Rounded or Polygonal Scrapers.*

Plate xxxiv, figs. J_1.—A fairly large flat type of scraper with a smooth upper surface showing the bulb of percussion and concentric rings. The lower surface is facetted and flaked. The concave slope surface affords a thick grip for the scraper. All the other edges are thin enough for cutting, and that they have been used is indicated by a number of fine serrations.

Plate xxxiv, figs. J_2.—A distinctly rounded type with innumerable facets on the lower surface. The slope surface is too small to be clearly discerned. On the upper surface is the bulb of percussion and a well-marked concentric ridge. All edges, except the one at the thicker end near the bulb, have been serrated by use.

K *Scrapers with a Curved Cutting Edge.*

Plate xxxiv, figs. K_1.—This flake is interesting in that it has a bulb of percussion on both the upper and lower surfaces. It is therefore obvious that this flake has been broken off a previously formed larger flake. The upper surface has a much fresher appearance than the other. Each has its own slope surface which, with another facet composed of an original weathered area, forms the upper thick portion or grip of the scraper. The two main fractured surfaces meet to form a thin curved cutting edge which is highly serrated.

Plate xxxiv, figs. K_2.—In this specimen the cutting edge is curved in a manner similar to the one above, but there is only one bulb of percussion, which is surrounded by concentric lines. The lower surface is unfacetted, and, with the slope surface, appears to be part of the original weathered core. Small facets caused by flaking are apparent on the right side of the slope surface. The cutting edge is in the normal position and shows fairly deep serrations.

Plate xxxiv, figs. K_3.—In the fracture of this flake a deeply curved cutting edge has been formed which gives it a distinctive shape. The flake is flat with a well-marked bulb of percussion on the upper surface. The lower surface is divided into two main facets by a ridge curved in the same direction as the serrated cutting edge. The slope surface is bruised. The specimen is an old one and has become discoloured.

Plate xxxiv, figs. K_4.—This flake, though apparently of more recent origin, is almost precisely similar in form to K_3. It has the same deeply curved cutting edge, an upper surface with a well-marked bulb of percussion, and a lower surface divided into two

main facets by a curved ridge. The slope surface, though small, is quite distinct, and shows a certain amount of bruising at the edges.

L. *Acicular or Elongated Scrapers.*

Plate xxxiv, figs. L_1.—This specimen is a transition type between the rounded and elongated scrapers. The upper surface has a distinct bulb of percussion which makes the thicker and wider end of the flake. It narrows slightly towards the base. The lower surface is divided into three main facets by vertical ridges. These facets have again been divided by flaking. The upper and lower surfaces do not meet to form a thin edge, so the desired effect has been obtained by secondary chipping. The slope surface is at the top of the scraper and is inclined in the normal manner from the lower to the upper surface.

Plate xxxiv, figs. L_2.—A typical elongated scraper. The upper surface is smooth with a prominent bulb, but no concentric lines. The raised lower surface is composed of three triangular facets. These have been both flaked and bruised in the formation of the scraper; there is no distinct slope surface. At the top and bottom the flake is blunt, but the two long edges have the serrations which show they are the useful sides.

Plate xxxiv, figs. L_3.—Is an elongated scraper in which the prominent bulb of percussion is at the side instead of the top of the flake. The lower surface is divided vertically into two facets, the thicker one of which has been considerably chipped and flaked. The other facet is smooth and helps to form the thin and serrated cutting edge. The slope surface is small but quite distinct.

Plate xxxiv, figs. L_4.—This is another specimen in which the two main facets are simple flaked surfaces. Where these two join is the cutting edge, which has been retouched by secondary chipping. Opposite and at right angles to the cutting edge is another facet, which is part of the original core surface. The two slope surfaces also show the exterior of the core at either end of the flake.

Plate xxxiv, figs. L_5.—A fairly flat elongated flake, of which both the upper and lower surfaces are facetted. On the upper surface the bulb of percussion is very small, but is marked by a few concentric lines on the main facet which helps to form the cutting edge. On the other thicker side are two small facets. The lower surface is irregularly divided into a number of faces. On the thicker edge a certain amount of pressure flaking has been done to give a smoother grip for the fingers. A little secondary chipping has also been done on the cutting edge. There is no apparent slope surface.

Plate xxxiv, figs. L_6.—Is another flake with a simple upper surface and a raised lower surface. There is no bulb of percussion,

but the concentric lines are in the form of distinct ridges. The lower surface has three facets, two of which have been reflaked. Both the point and the two long sides have been trimmed by secondary chipping to give a good scraping edge.

M. *Trigonal Scrapers* (Figure 5).

These are so named because they are composed of three facets only, one on the upper surface and two on the lower, which has thus a dividing ridge running throughout its length. It is necessary that at least two other flakes should have been removed from the core in order to give this trigonal formation.

Plate xxxv, figs. M_1.—Is a rather elongated flake with an indistinct bulb of percussion situated at the top. The upper surface is smooth except for a number of small flakes which have been chipped off along the side opposite the bulb: the lower surface is formed in the normal manner. It shows secondary chipping along the side next the bulb, and thus the two long sides of the scraper have been prepared for use. The top end of the flake is the thickest portion and has the slope surface which has been bruised during flaking.

Plate xxxv, figs. M_2.—This flake is of the normal shape but is peculiar in having the bulb of percussion at the lower or pointed end. The bulb is small, and the slope surface very minute. This end of the scraper is therefore thinner than the top end, which is quite thick and has two facets at right angles to the upper and lower surfaces of the scraper. The two long vertical edges, one of which has been retrimmed, show small serrations due to use.

Plate xxxv, figs. M_3.—This flake is not very large and yet in form it is a typical trigonal scraper. It has a smooth upper surface with a distinct bulb of percussion at the top and two concentric ridges. The slope surface is well marked and shows a slight amount of bruising. On the lower surface the two facets are divided by a curved ridge which joins the two sides in a slight point at the base. The two sides are also curved, one concave and the other slightly convex; the convex side has been treated with secondary chipping.

N. *Thick-backed Scrapers.*

These are very similar to types described before, except that they are much thicker and have usually only one cutting edge.

Plate xxxv, figs. N_1.—This flake has a simple, smooth, upper surface from which the bulb of percussion and the slope surface have been flaked away, thus forming a third surface at right angles to the other two. This gives the flake a wedge formation. The lower surface is composed of two triangular facets which form two cutting edges on the lower portion of the flake. The third surface, or "back" of the scraper is very thick and broken

into a number of facets. Where it joins the lower surface it has been retouched by secondary chipping. The cutting edge has minute serrations.

Plate xxxv, figs. N_2.—A specimen also showing wedge formation, with a smooth upper surface, a facetted lower surface, and a thick surface opposite the cutting edges. The upper surface has a small bulb of percussion but no concentric lines. The lower surface is divided by curved ridges into a number of faces. There are two curved cutting edges, but one is more regular than the other and has therefore been used more freely and has more serrations. The "back" of the scraper has been smoothed off by flaking and bruising.

O. *Scrapers Showing Secondary Chipping.*

These flakes are all fairly small, but they exhibit variety in shape and form. They differ from the other scrapers since they have been subjected to secondary treatment in order to make them more suitable to the uses required of them. They mark a big step forward in the formation of definite stone implements.

Plate xxxv, figs. O_1.—An irregularly flaked scraper similar to types described above in that it has a simple upper surface, a facetted lower surface, and a third surface or "back" opposite the cutting edge. In this case, however, the back is quite narrow. The upper surface does not show the bulb of percussion. It is quite simple except for secondary chipping along the cutting edge. The lower surface is divided into two main facets with smaller ones at either end. Extensive pressure flaking has been executed along the back in order to give a firm grip.

Plate xxxv, figs. O_2.—A similar type but without the definite ridge along the back. The upper surface is simple and has had the bulb of percussion broken away with the resulting formation of a crude and uneven ridge, much flaked and broken. The lower surface has also been broken by flaking. The cutting edge is directly opposite the ridge and has been trimmed by pressure.

Plate xxxv, figs. O_3.—A small flake, elliptical in shape, which also shows the formation of a rudimentary ridge along the back opposite the cutting edge. The upper surface has a prominent bulb of percussion. The lower surface is smooth but has been flaked along the upper edge. The ridge has been smoothed by pressure flaking, while the cutting edge is curved and serrated.

Plate xxxv, figs. O_4.—This flake is a small and narrow one in which both the upper and lower surfaces are simple and unfacetted. There has been an attempt to form a ridge along the back, but in this case it is very narrow. Secondary flaking and chipping have been done along the back and also along the cutting edge.

P. *Spokeshaves.*

These are simply a combination of the irregular "useful" flake and the scraper which has been modified by secondary chipping. In this case an irregular flake has been chosen and a suitable edge trimmed to form a small concave area with a rough scraping edge. These concavities are used for the definite purpose of smoothing off the rounded tips of spears (Figure 6).

Plate xxxv, figs. P_1.—This flake has a smooth upper surface and a raised and highly facetted lower surface. In appearance it resembles the "useful core." All the sharp edges have been retrimmed and on one of these is the small concave area used for smoothing spears.

Plate xxxv, figs. P_2.—A much flatter flake composed of a greenish jasper. It is a typical flake with an upper surface showing a bulb of percussion, and a highly flaked lower surface. It has two cutting edges, one of which is serrated by use. On the other is the small concave depression, which gives it a place in this group.

Chipped-Back Knives.

Under this heading are grouped a number of flakes of varying size all of which have been treated by pressure flaking to give an unusual knife-like form. They differ in shape from the well-known "La Gravette"[18] type, specimens of which are found abundantly south of Newcastle at Redhead. They are thicker and more blunted at both ends; similar, though more perfect types, described by Thorpe,[19] from Mayfield in the Newcastle area, have been compared by him to the "sector of an orange." Small chipped-back knives have been described by Horne and Aiston[20] as occurring in Central Australia, where they are used for surgical purposes. These latter, however, are pointed at the ends, while the ones from this area are blunted and would seem to have been used for skinning animals or chopping at their flesh rather than for surgery. That the knife has been evolved from the scrapers showing secondary chipping is clear from the number of intermediate types which were found. Many of the specimens show the fine flaking which distinguishes the "Aurignacian retouch."[21]

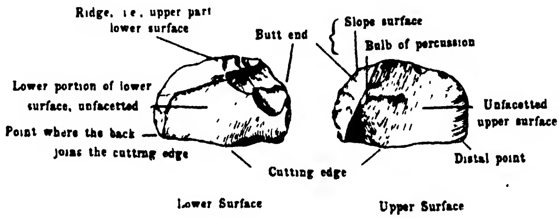
Q. *Flakes Intermediate Between the Scraper and the True Chipped-Back Knife* (Figure 7).

Some of these are primitive transition types while some are knives which were left unfinished or spoilt in the making. Materials being scarce in the locality, the spoils as well as the good tools had

[18] Breuil.—Revue Anthropologique. Jan.-Feb., 1911.
[19] Thorpe.—Rec. Austr. Mus., xvi, 5, 1928, p. 241.
[20] Horne and Aiston.—Savage Life in Central Australia. London, 1924.
[21] Sollas.—Ancient Hunters. London, 1911; and Osborn—Men of the Old Stone Age. New York, 1916.

to be used, and this, no doubt, is the reason why we do not find such perfectly made knives in this district as at Newcastle, where chert is more plentiful.

Plate xxxv, figs. Q_1.—The upper surface shows a prominent bulb of percussion, with a concentric ridge and a long cutting edge opposite the bulb. The lower surface is facetted after the manner of the normal scraper and has one main ridge parallel to the cutting edge. The back of the flake is on the thick side and has only been crudely chipped, so that, though it form a grip for the finger, it is crude and uneven. As the chipped back is not clearly and evenly defined this form resembles the scraper more than the true knife.



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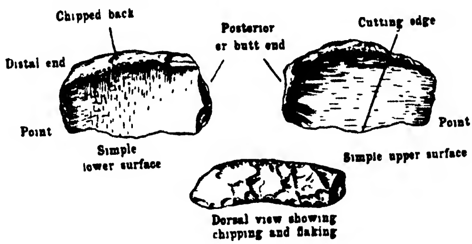

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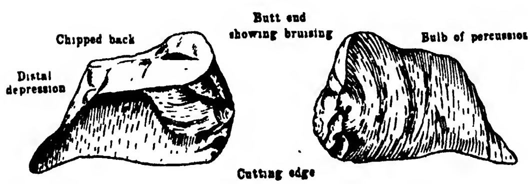

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FIGURES 7–9.

7. A prepared flake showing the transition from a scraper to a chipped-back knife. 8. A simple chipped-back knife. 9. A chipped-back knife showing dorsal depression.

Plate xxxv, figs. Q_2.—A small, rather high flake, with smooth under surface showing bulb of percussion at the top. The lower surface is divided into three facets. The back is quite well-defined and the serrated cutting edge terminates against it in a definite point.

Plate xxxv, figs. Q_3.—A medium sized specimen roughly flaked to form an upper and lower surface, with a broad ridge along the back opposite the cutting edge. Along this ridge the flaking is crude but some chipping has also been done. The upper and lower surfaces are both smooth and unfacetted, but the former shows a prominent bulb of percussion. The cutting edge shows compound flaking and pressure chipping. Both ends of the knife are blunt.

Plate xxxv, figs. Q_4.—In this transition type no effort has been made to flatten down the upper side in order to make a definite ridge. The flake is a normal one and shows an upper surface with bulb of percussion, a facetted lower portion, and a slope surface, which is part of the original core. The lower surface is divided by a main ridge into a simple surface near the cutting edge, and an upper thicker portion which is facetted. It is this upper portion which in later specimens is blunted by chipping and forms the back of the knife. At the distal end the cutting edge is extended into a point.

Plate xxxv, figs. Q_5.—This is a more suitable flake as it is elongated and has the bulb of percussion on the end instead of the side. The upper surface is smooth; the lower surface is divided into two distinct portions of which the lower simple one is the larger. The upper portion is facetted and has been slightly flaked but not completely blunted. The butt of the knife is formed by the bulb of percussion and the slope surface, while at the distal end the cutting edge joins the back in a fairly distinct point. The flake has all the features necessary for the preparation of a true chipped-back knife (see Figure 7).

Plate xxxv, figs. Q_6.—A more irregular form, yet with a distinct ridge extensively blunted by chipping. The deeply serrated cutting edge is curved and both ends are blunted. The specimen is only a crude one, yet it shows the transition stage.

R. *Imperfectly Formed Chipped-Back Knives.*

In these specimens there has been a distinct attempt to form the true chipped-back knives, but they are crude and incomplete. Their imperfection may be due to unskilled workmanship, to inequalities in the fracture of the chert, or simply to haste in preparation which caused them to be left unfinished.

Plate xxxv, figs. R_1.—A fairly small implement almost oval in shape. The lower surface has three facets and the upper surface, though composed of one facet only, is irregular. The cutting edge

therefore is not even, but it has been used and broken into minute serrations. The ridge along the back has been formed by flaking and has then been retrimmed by chipping along each side. In this case the point of the knife is on the left-hand side of the upper surface. This is noted to be a variable factor probably dependent on the individual character of the flake.

Plate xxxv, figs. R_2.—A small specimen in which the bulb of percussion is at the side instead of at the butt end. Both upper and lower surfaces are simple and smooth. The ridge at the back is very broad and crudely flaked. Towards the distal end trimming by pressure has been carried out, but it has been left incomplete. The cutting edge is long and slightly curved and shows marked serrations due to use. The knife is pointed at one end and blunted at the other and has been used as a tool while not quite finished.

Plate xxxv, figs. R_3.—A small type, oval in shape, in which the formation of the ridge is more complete. It has been flattened and retrimmed by pressure flaking. Both upper and lower surfaces are smooth, the former showing concentric lines but no bulb of percussion, as it has been flaked away. The cutting edge has been strongly chipped, and terminates on one side in a pointed distal end and on the other in a blunted posterior. Its imperfection lies in the insufficient amount of chipping along the back.

Plate xxxv, figs. R_4.—A larger type more triangular in shape. The bulb of percussion on the upper surface has been partly flaked away to form the butt end of the knife. The lower surface has a ridge running from the back to the cutting edge, and the upper facet is part of the exterior of the original core. The cutting edge is long and serrated. The distal end of the knife is brought to a distinct point which forms the apex of the triangle. Along the back is some excellent chipping, but this has not been carried far enough.

S. *Simple Chipped-Back Knives* (Figure 8).

Plate xxxvi, figs. S_1.—A small implement very carefully and finely made. Both upper and lower surfaces are simple and smooth and the ridge along the back is narrow, so that the knife is flatter than usual. It is longer than it is wide and almost semi-circular in shape, with no difference in the formation at either end. The cutting edge is badly chipped, which shows that the knife has been subjected to rough use. The back is compoundly flaked and chipped.

Plate xxxvi, figs. S_2.—Another small flat type, but one which is more oval in shape owing to its distinctly curved cutting edge. The bulb of percussion and small slope surface are at the distal, instead of the butt end. The pressure flaking is fairly even and has been executed all along the back. The cutting edge is chipped and serrated by use.

Plate xxxvi, figs. S_3.—A similar form, somewhat larger, with a wider ridge carefully flaked and chipped. The chipped back is semi-circular and joins the cutting edge in two blunt ends. The end opposite the bulb of percussion is more carefully made as it is the front of the knife. The lower surface is rough owing to inequalities of fracture, and the cutting edge is deeply serrated.

Plate xxxvi, figs. S_4.—A small specimen, with a carefully chipped back not so evenly and regularly made. The front of the knife is carefully flaked and is more regular than the posterior end. The lower surface has been facetted by flaking on the upper portion near the ridge.

Plate xxxvi, figs. S_5.—Another small type not so perfectly made. The prominent bulb of percussion on the upper surface occurs to one side instead of at the end. The lower surface is simple and smooth. The ridge is clearly defined and carefully and finely chipped at the front. The cutting edge is curved and has been trimmed by the removal of a regular series of small flakes. It thus affords a good example of the "Aurignacian retouch" mentioned above.

Plate xxxvi, figs. S_6.—A larger specimen with a carefully flaked distal end and a wider unflaked butt end, near the bulb of percussion. The ridge is formed along the back and down the distal point, but has been omitted from the posterior end. The ridge is wide and formed by normal flaking, while the edges along each side have been retrimmed by pressure. The edge which joins the lower surface forms a prominent ridge. The cutting edge has been roughly flaked, probably during its use as a knife. The bulb of percussion gives a good thumbhold, and the ridge forms a rest for the forefinger, so that the knife fits comfortably into the hand.

Plate xxxvi, figs. S_7.—A larger and cruder type of chipped back knife with a curved cutting edge which makes it oval in outline. The ridge is restricted along the back of the implement, while the serrated cutting edge curves up to meet it. The upper surface is smooth except for the bulb of percussion. The lower surface has been roughly flaked near its junction with the ridge. This latter is fairly wide and has been formed by the compound action of percussion and pressure.

Plate xxxvi, figs. S_8.—A larger specimen of similar type more crudely made. It is oblong in shape as the length is a good deal greater than the width. The unfacetted lower surface is part of the original core exterior. The upper surface is divided into two portions by a longitudinal ridge. Near the cutting edge it is simple and smooth, but the upper portion has been crudely flaked causing irregularity in the shape of the ridge along the back. This ridge has been formed by flaking and is only chipped along the edge where it joins the lower surface, and down the distal point of the

knife. The cutting edge has been extensively flaked and chipped along the weathered surface in order to prepare it for use. This seems to indicate that the implement has been used more as a scraper than as a knife.

T. *Ridged Chipped-Back Knives.*

These are quite similar to the types described above, but they have a distinctive ridge extending from the chipped back to either the distal or the posterior end of the cutting edge.

Plate xxxvi, figs. T_1.—A medium-sized specimen in which the ridge runs from the back to the posterior end of the knife, thus dividing the lower surface into two facets. The bulb of percussion has been broken off in the formation of the back, which is very wide, but which tapers away at the posterior end. At the forward end it is also narrower, and was originally continued down to the point, where it has now been broken away by use. The back has been treated in the usual manner, with crude flaking followed by chipping along the edges. The cutting edge is flaked and chipped along the upper surface.

Plate xxxvi, figs. T_2.—A larger flake with a similar ridge running across the lower surface to the posterior end. The butt end is formed by a prominent bulb of percussion and a small slope surface. The back of the knife is narrow and extensively chipped, even down to the distal end. The cutting edge is long and straight and has the serrations confined to a region near the point, which has obviously been the most used part of the implement.

Plate xxxvi, figs. T_3.—The distinguishing ridge extends from the chipped back to the front end of this implement. The bulb of percussion is located on the side near the chipped back, to which it imparts an irregular shape. The chipped back is not sufficiently extensive to reach the extremities of the cutting edge. Both sides of the implement are blunt. The cutting edge has been treated on both sides by the small regular flaking of the "Aurignacian retouch."

Plate xxxvi, figs. T_4.—A smaller specimen with two distinct facets on the lower surface. The ridge along the back is irregular and only crudely flaked. The cutting edge shows signs of use by the presence of innumerable minute serrations.

U. *Wedge-bladed Chipped-back Knives.*

These are distinguished by their short thick form and almost square outline. The sides are nearly as long as the cutting edge thus giving the knife a wedge or chisel shape.

Plate xxxvi, figs. U_1.—A very fine specimen spoilt by the fact that it has been left incomplete. The chipping along the back has been carefully done from the distal point to almost half-way across.

after which it is left in a very crude, roughly flaked condition. It has thus an irregular outline, although the sides are long enough to give it a wedge-like appearance. The chipped back is noticeably broad. The cutting edge is fine and straight, but has been roughened by flaking.

Plate xxxvi, figs. U_2.—A smaller implement, oblong in outline and with a ridge from the back to the posterior end. The back is not clearly defined except for some fine pressure flaking along the edge where it joins the upper surface. Although it exhibits the typical wedge shape it is a crude and primitive type. The cutting edge has been chipped during its use as an implement.

Plate xxxvi, figs. U_3.—Although this flake is smaller, it is similar to U_2, but more care has been taken in its manufacture. A distinct point, chipped on both sides has been produced. The remainder of the back is crudely flaked, and only chipped along the edge where it joins the upper surface. Such chipping as has been done is sufficient to form a comfortable grip, and that it has been of use is indicated by the serrated and chipped cutting edge.

Plate xxxvi, figs. U_4.—Another crude and primitive type on which flaking, but no secondary chipping, has been done. It is roughly wedge-shaped, with a smooth upper and lower surface and a crudely facetted back. The cutting edge is good and has been slightly serrated by use.

V. *Chipped-back Knives with Dorsal Depression* (Figure 9).

These types are a somewhat specialised variety and were not found in any large number. Similar forms, however, have been collected from the Newcastle district, in sufficient quantities to establish it as a definite artefact.

Plate xxxvi, figs. V_1.—A crudely made chipped-back knife showing the typical method of manufacture. On the upper surface is a bulb of percussion which forms the thick butt of the posterior end. The distal end is in the form of a long point, where the secondary chipping has made a distinct depression, which affords a firm grip for the forefinger. The remainder of the dorsal ridge is unchipped, and has been left in its primitive flaked condition. The curved cutting edge is thin and sharp and shows minute serrations.

Plate xxxvi, figs. V_2.—A crude and primitive form, but one which is interesting since the distal end has a point similar to V_1. It is triangular in section with a smooth upper and lower surface and a wide dorsal ridge. This ridge has been trimmed on either side by pressure flaking. The fracture on both surfaces is uneven, and in the case of the lower a circular depression has formed. This affords an excellent rest for the thumb, but cannot be considered as an intentional modification. The thin curved cutting edge has been rendered uneven by extensive use. At the posterior end the implement is truncated, probably by recent fracture.

Crudely Flaked Celts.

These flaked celts are very primitive and crudely made, but they have each a prepared cutting edge which is located either at the side or at the front. In the latter case they were probably used as axes, while in the former they would be held differently and given a chopping motion, although the two uses would be interchangeable. The following division into groups is based on the position of the cutting edge.

W. *Flaked Hand Axes.*

Plate xxxvii, figs. W_1.—A massive specimen in quartz keratophyre which has been formed by flaking. The simple upper surface has a distinct bulb of percussion which, with the slope surface, forms the thick butt end of the implement. The axe was originally triangular in cross-section, but the two main facets of the lower surface have been altered by secondary flaking. The side opposite the bulb of percussion has been flaked to form the cutting edge, which shows secondary chipping and serrations due to use. Though crude it has a definite form, and further evidence of its authenticity lies in the fact that it was found buried with a skeleton in the aboriginal cemetery at Morna Point.

Plate xxxvii, figs. W_2.—This is an interesting specimen as it was the largest chert implement found at Morna Point. It is two-sided with a simple upper surface and a facetted lower surface. The posterior end of the axe is narrower instead of wider than the cutting edge as there is no bulb of percussion and only a small slope surface. It is roughly triangular in outline with the lower surface divided into three facets by ridges which meet to form the highest point in the axe. There is compound secondary retouching along the cutting edge and at either side. It consists of a row of large cavities due to flaking, which enclose numerous smaller ones due to chipping.

Plate xxxvii, figs. W_3.—Another type of similar form which has been flaked from a piece of hornblende-andesite. At the butt end is a distinct bulb of percussion and the slope surface. The upper surface is simple and fairly smooth, while the lower surface has been facetted by crude flaking, although a portion is left which shows the weathered exterior of the original core. The axe has been trimmed by secondary chipping on both sides as well as on the front cutting edge.

Plate xxxvii, figs. W_4.—A very crude specimen, imperfectly formed. It has been flaked from a boulder of quartzite, and portion of the original weathered exterior is apparent on the lower surface. The upper surface was at first a simple facet, but has later been subjected to crude flaking at the edges. The lower surface has

also been flaked at the edges and an irregular cutting edge is the result.

Plate xxxvii, figs. W_5.—This axe is made of quartz-porphyry and is more carefully and evenly formed. In shape it is similar to W_2 with the butt end narrower than the prepared cutting edge. The upper surface is smooth and simple. The lower surface is raised and has been flaked round the sides to give the required sharpness to the edges. A flake driven off from the front has left a sharp line of division between the butt end and the cutting edge. The axe has been trimmed all round by secondary chipping.

X. *Crude Choppers.*

Plate xxxviii, figs. X_1.—This implement in its general form and character shows a marked resemblance to the wedge-shaped chipped back knives described above, although it is very crudely made and is a massive type formed of hornblende-andesite. It has a distinct dorsal ridge, unevenly flaked, which joins the cutting edge in a retouched distal point. The posterior end has been made blunt by rough flaking. The upper and lower surfaces are both simple and at their junction form the straight cutting edge.

Plate xxxviii, figs. X_2.—A crudely flaked chopper in quartz-porphyry, which is similar in form to X_1. The upper surface is fairly even, but the lower is facetted by flaking, which is especially prominent along the cutting edges and towards the distal end of the implement. The blunted ridge is confined to the back, where it affords a firm and comfortable grip for the hand. The posterior end is wider than the distal end and has been broken away by rough flaking. The cutting edge is irregular as in X_1.

Plate xxxviii, figs. X_3.—A massive flake of weathered igneous rock, probably felsite. The upper surface is even and unfacetted, while the lower surface is divided into two portions by a prominent ridge. The lower portion is simple and joins the upper surface in a straight cutting edge. The upper portion has been flattened by flaking, and forms a primitive dorsal ridge which extends down to the cutting edge on the distal side. The cutting edge shows secondary flaking.

Y. *Massive Scrapers.*

In these massive igneous types there is no definitely prepared and limited cutting edge; they are polygonal in shape, with many sides suitable for use.

Plate xxxviii, figs. Y_1.—A fairly large flake of hornblende-andesite with a smooth upper surface on which is part of a con-

centric ridge, but no bulb of percussion. The lower surface, part of the exterior of the core, has been treated by crude flaking all round the edge. Thus it has a very irregular outline, with a number of sharp edges where these flakes join the upper surface.

Plate xxxviii, figs. Y_2.—A similar irregular form in hornblende andesite, with an unfacetted upper surface and a crudely flaked lower surface. There is a distinct slope surface and both sides show a small bulb of percussion, although on the lower surface it is limited to one facet. Two sides of the implement have been trimmed by flaking and these are the ones which were used for general scraping purposes.

EXPLANATION OF PLATE XIX.

FLAKED CELTS.

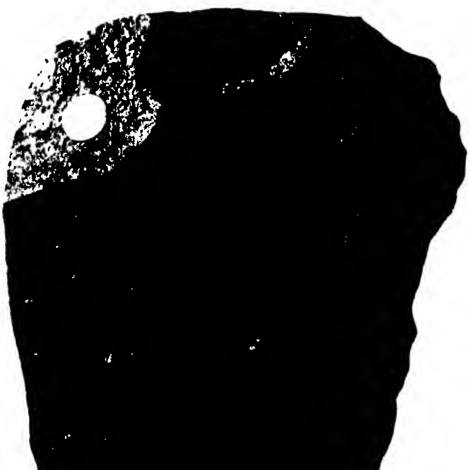
Figs. 1-2. Sandgate, Hunter River, New South Wales, $^3/_5$ and $^7/_{10}$ natural size respectively.

Fig. 3. Morna Point, south of Port Stephens, New South Wales. $^7/_{10}$ natural size.

Fig 4. Speer's Point, Lake Macquarie, New South Wales. $^3/_5$ natural size.

1

2



3

4

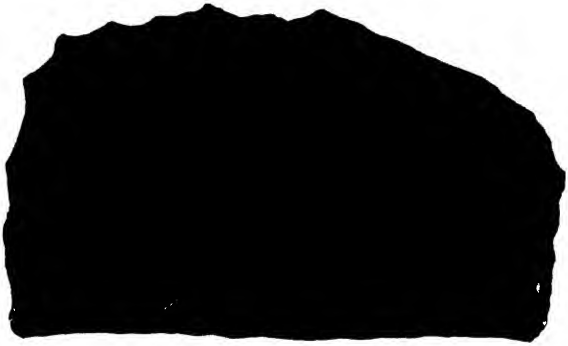
G. C. CLUTTON, Photo.

EXPLANATION OF PLATE XX.

CHIPPED-BACK IMPLEMENTS.

Figs. 1-2. Glenrock Lagoon, south of Merewether, New South Wales. In the collection of the Department of Geography, University of Sydney. $^3/_5$ and $^7/_{10}$ natural size.

Fig. 3. Morna Point, south of Port Stephens, New South Wales. $^7/_{10}$ natural size, in porphyritic rock.



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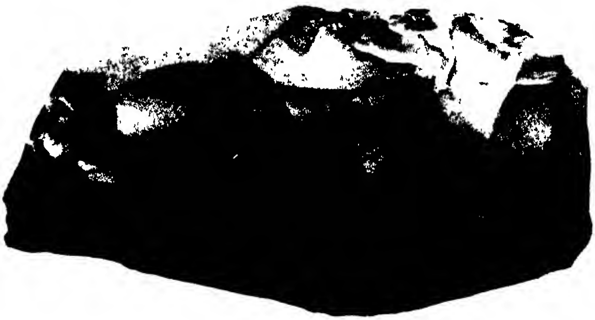

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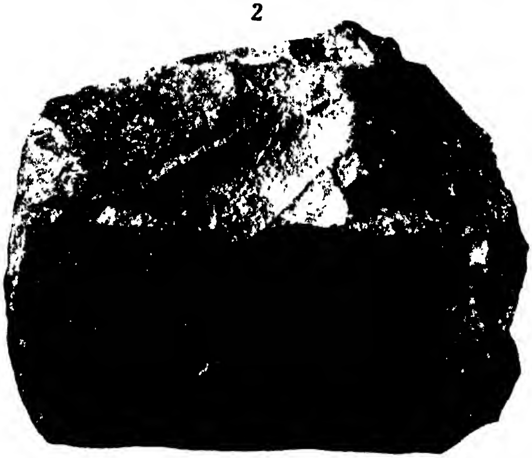

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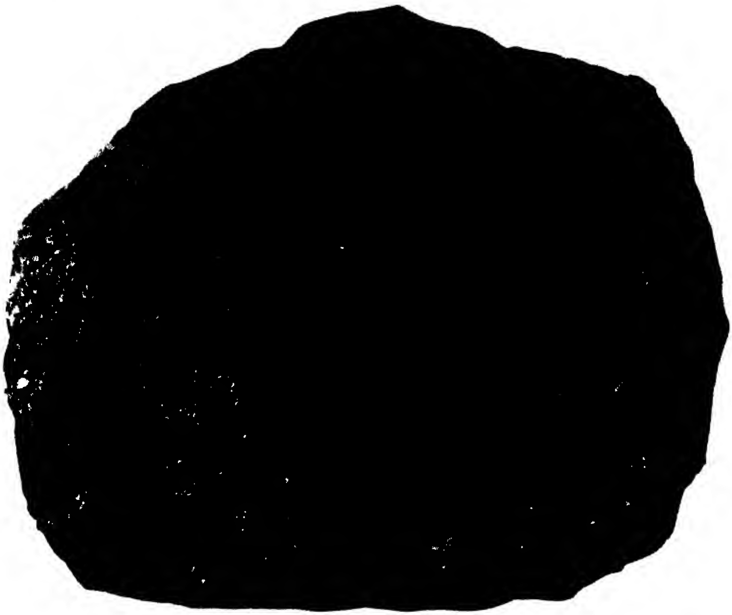
G. C. CLUTTON, Photo.

EXPLANATION OF PLATE XXI.

CHIPPED-BACK IMPLEMENTS.

Figs. 1-2. Composed of basalt. One Mile Beach, Anna Bay, south of Port Stephens, New South Wales. $^4/_5$ and $^7/_{10}$ natural size.

Fig. 3. Composed of felsite. Beach south of entrance, Lake Macquarie, New South Wales. $^7/_{10}$ natural size.



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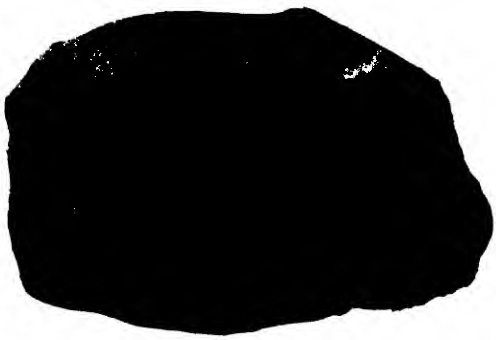

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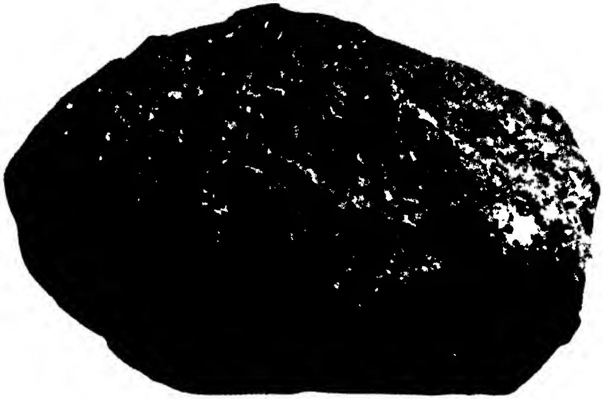
G. C. CLUTTON, Photo

EXPLANATION OF PLATE XXII.

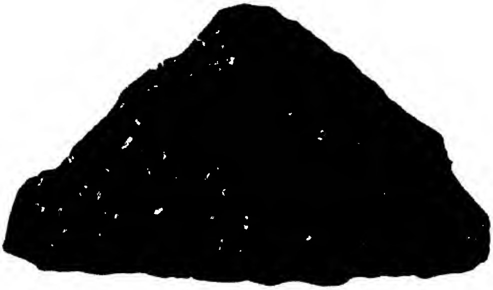
Figs 1-2. Massive chipped-back implement, composed of porphyritic rock. One Mile Beach, Anna Bay, New South Wales. $^7/_{10}$ and $^1/_2$ natural size.

Fig. 3. Crescentic knife, or scraper. One Mile Beach, Anna Bay, New South Wales. $^7/_{10}$ natural size.



1

2



3

G. C. CLUTTON, Photo.

EXPLANATION OF PLATE XXIII.

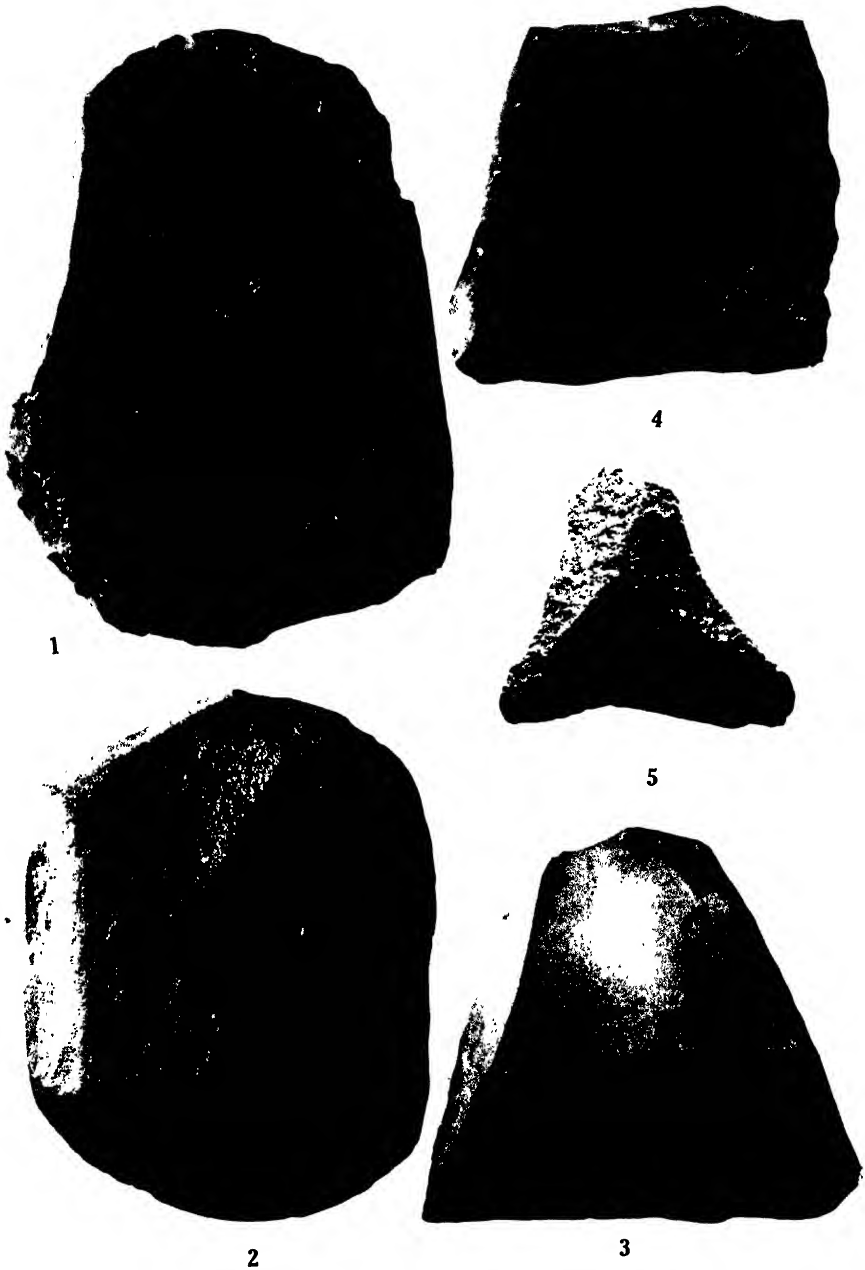
Fig. 1. Flaked "Celt," composed of porphyritic rock. One Mile Beach, Anna Bay, New South Wales. $^3/_5$ natural size.

Fig. 2. Normal ground-axe in olivine-basalt. One Mile Beach, Anna Bay, New South Wales. $^7/_{10}$ natural size.

Fig 3. Triangular implement in chert. Speer's Point, Lake Macquarie, New South Wales. $^7/_{10}$ natural size.

Fig. 4. Rectangular implement. Cockle Creek, near Lake Macquarie, New South Wales. $^7/_{10}$ natural size.

Fig. 5. Triangular scraper, composed of porphyritic rock. One Mile Beach, Anna Bay, New South Wales. $^7/_{10}$ natural size.



G. C. CLUTTON, Photo.

EXPLANATION OF PLATE XXIV.

CHIPPED-BACK IMPLEMENTS.

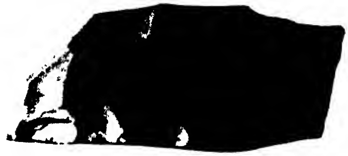
Figs. 1-1*a*. Glen Rock Lagoon, south of Merewether, New South Wales. $^3/_5$ natural size.

Figs. 2-3*a*. Mayfield, Newcastle. $^3/_5$ natural size.

Figs. 4-4*a*. Rock Shelter, Lane Cove River, Port Jackson, New South Wales. $^3/_5$ natural size, in jasperoid rock.

Figs. 5-5*a*. Bar Beach, Newcastle, New South Wales. Natural size.

1



1a

2

2a

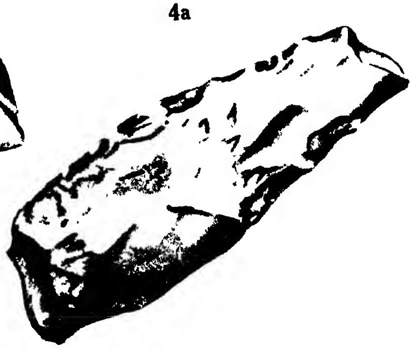
3

3a

4

4a

5



5a

G. C. CLUTTON, Photo. (1-4).
JOYCE K. ALLAN, del. (5).

EXPLANATION OF PLATE XXV.

Figs. 1-1*a*. Chipped-back knife, Mayfield, Newcastle, New South Wales. Natural size.

Figs. 2-2*a*. Chipped-back knife. Sand dunes, south of Redhead, New South Wales. Natural size.

Figs. 3-3*a*. Chipped-back knife. Sand dunes, south of Redhead, New South Wales. Natural size.

Fig. 4. Bone implement, from kitchen-midden. Mooney Mooney Creek, Hawkesbury River, New South Wales. $^2/_5$ natural size.

Fig. 5. Incised stone. Galston, near Hornsby, New South Wales. $^1/_2$ natural size.

1

1a

2

2a

3

3a

4

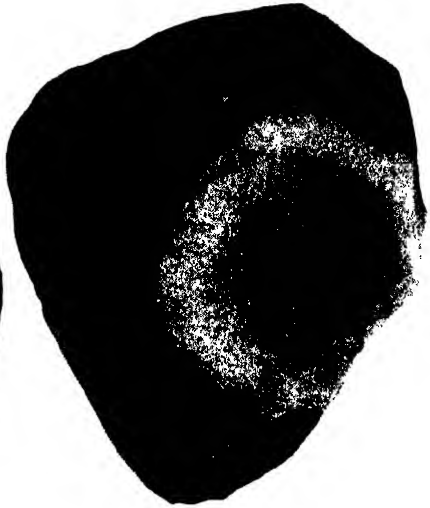
5

JOYCE K. ALLAN, del. (1-3).
G. C. CLUTTON, Photo. (4-5)

EXPLANATION OF PLATE XXVI.

Nardoo Mill Stones. Sand hills between Lake Boolabooka and the Darling River, western New South Wales.

1



2

1a

2a

G. C. CLUTTON, Photo.

EXPLANATION OF PLATE XXVII.

Fig. 1. Flaked Chopper. Kallara Holding, Darling River, western New South Wales. $^1/_2$ natural size.

Fig. 2. Doubly-grooved conical implement. Condobolin, New South Wales. $^1/_2$ natural size.

1

2

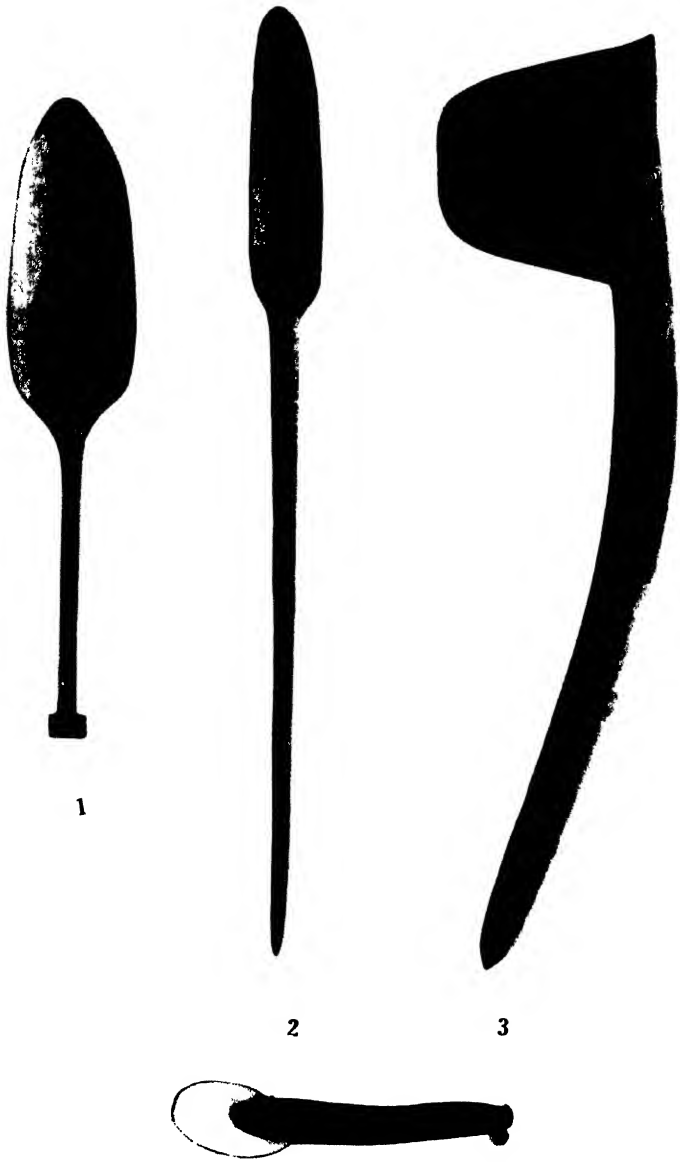
G. C. CLUTTON, Photo.

EXPLANATION OF PLATE XXVIII.

Figs. 1-2. Wooden shovels. Western New South Wales. $^1/_8$ natural size.

Fig. 3. Carved Lil-Lil. Lower Murray River, South Australia. $^1/_6$ natural size.

Fig. 4. Shell Spoon. Endeavour River, Queensland. $^1/_5$ natural size.



1 2 3 4

G. C. CLUTTON, Photo.

EXPLANATION OF PLATE XXIX.

Figs. 1-2. Boomerang-like Staves. (?) Gympie, Queensland, $^{3}/_{20}$ natural size.

Figs. 3-4. Carved Boomerangs. Queensland. $^{1}/_{8}$ natural size.

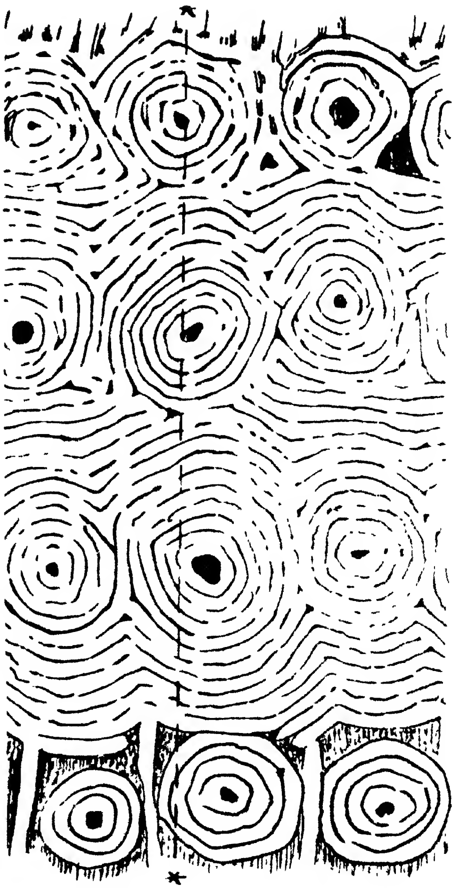
G. C. CLUTTON, Photo.

EXPLANATION OF PLATE XXX.

Fig. 1. Sacred Stick or "Jinkee." Cue, Western Australia. $^4/_5$ natural size.

Fig. 2. Ditto. Details of carving. $^4/_5$ natural size.

1



2

G. C. CLUTTON, Photo. (1).
EDITH A. KING, del. (2).

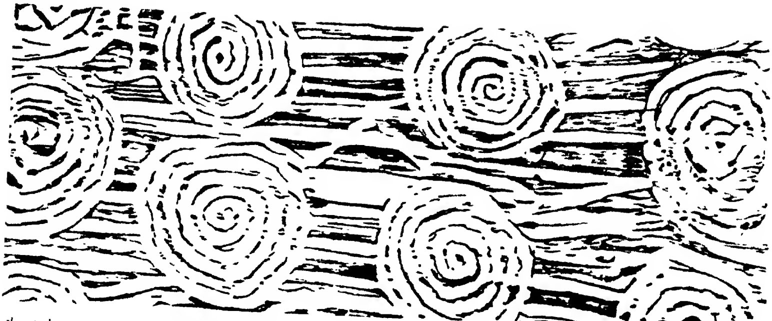
EXPLANATION OF PLATE XXXI.

Figs. 1-2. Rubbings of "Jinkees" in the J. F. Connelly collection, Perth, Western Australia.

Fig. 3. Flaked Axe. South of Croudace Bay, Lake Macquarie, New South Wales. $^4/_5$ natural size.

PLATE XXXI.

1



2

3

J. F. CONNELLY, del. (1-2).
G. C. CLUTTON, Photo. (3).

EXPLANATION OF PLATE XXXII.

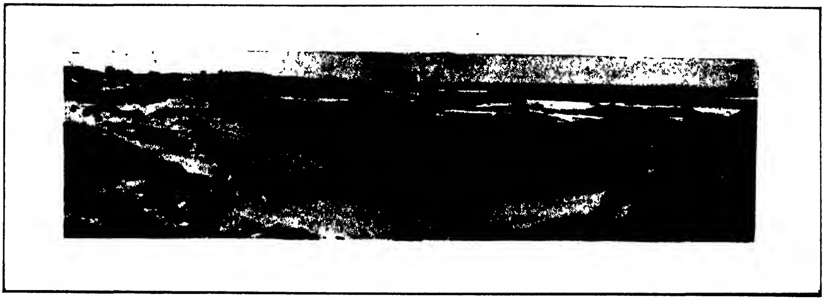
Fig. 1. View of Morna Point showing the rocky beach with shell middens.

Fig. 2. Scattered midden shells on the beach at Morna Point.

Fig. 3. A conical shell midden on the beach at Morna Point.

Fig. 4. The aboriginal workshop among the dunes at Morna Point.

Fig. 5. The quartz and felspar porphyry of the Morna Point headland.



1

2

3

4

5

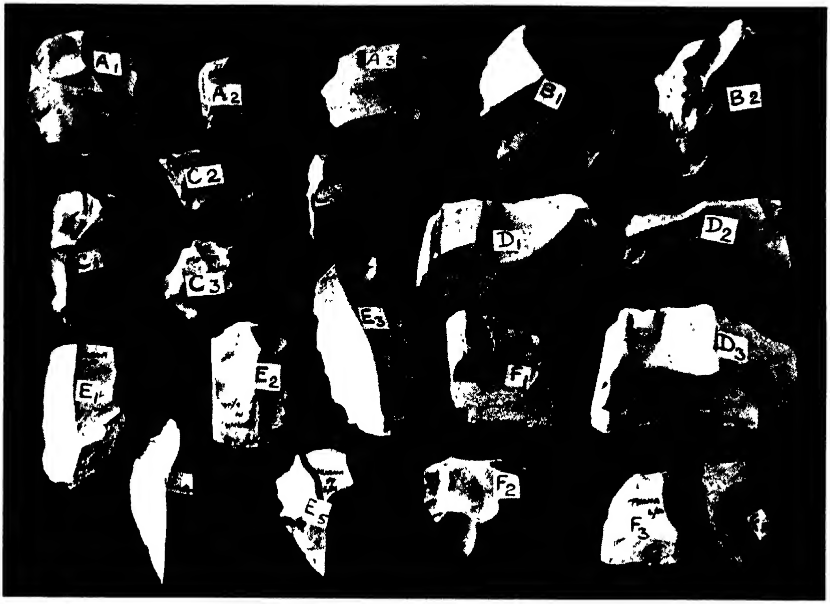
Lesley D. Hall, photo.

EXPLANATION OF PLATE XXXIII.

Fig. 1. Lower surface of cores and flakes with secondary chipping.

Fig. 2. Reverse view.

$\frac{2}{5}$ natural size.



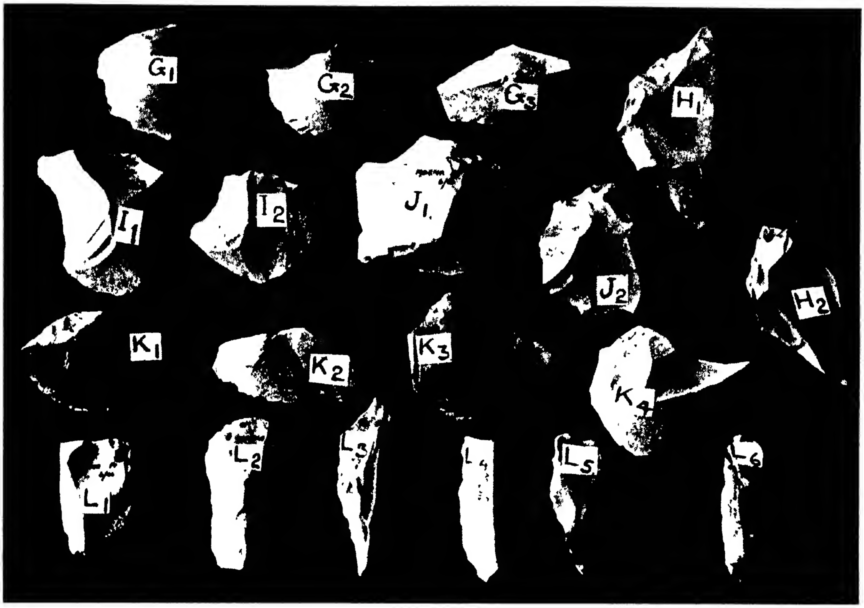
G. C. Clutton, photo.

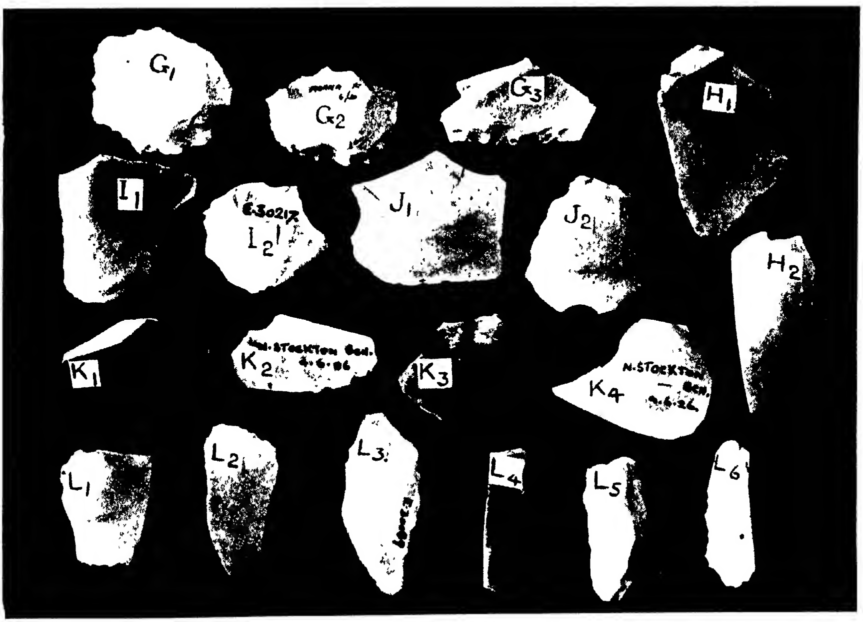
EXPLANATION OF PLATE XXXIV.

Fig. 1. Lower facetted surface of various types of scraper.

Fig. 2. Reverse view, showing the bulb of percussion.

$\frac{2}{5}$ natural size.





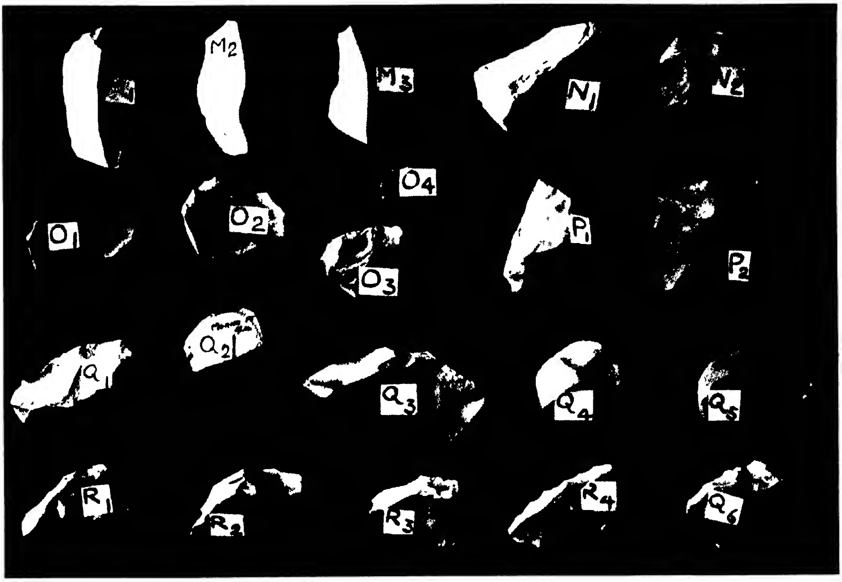
G. C. Clutton, photo.

EXPLANATION OF PLATE XXXV.

Fig. 1. Scrapers and imperfectly formed chipped-back knives.

Fig. 2. Reverse view showing the upper surface.

$\frac{2}{5}$ natural size.



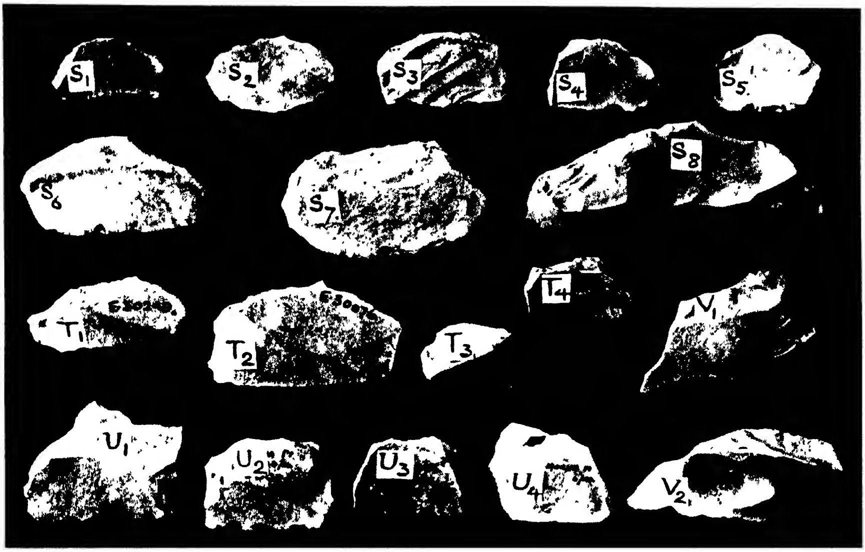
G. C. Clutton, photo.

EXPLANATION OF PLATE XXXVI.

Fig. 1. Chipped-back knives.

Fig. 2. Dorsal view.

$\frac{2}{5}$ natural size.



G. C. Clutton, photo.

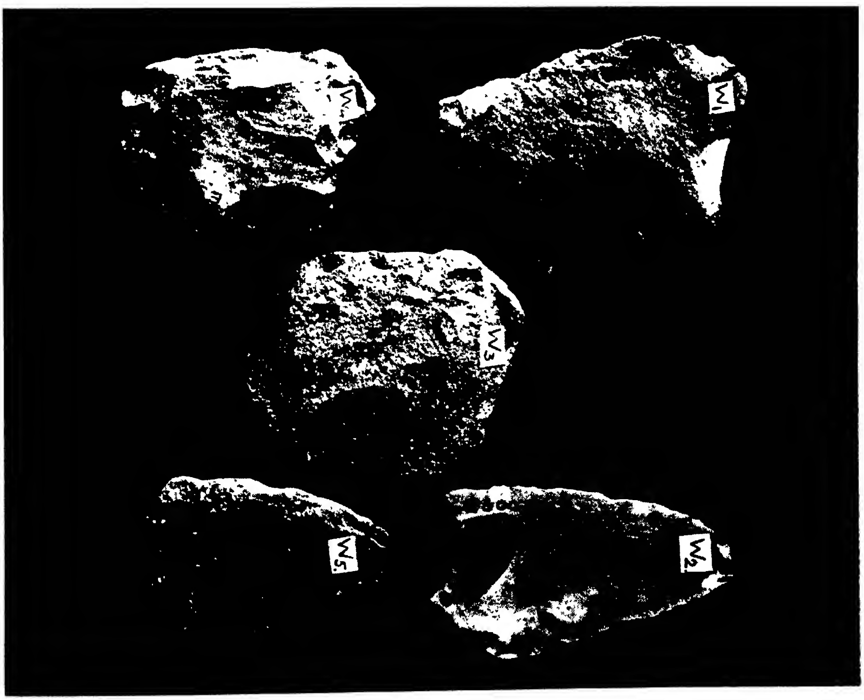
EXPLANATION OF PLATE XXXVII.

Fig. 1. Crudely flaked hand axes.

Fig. 2. Reverse view.

$\frac{2}{5}$ natural size.


W4
W1
W3
W5
W2

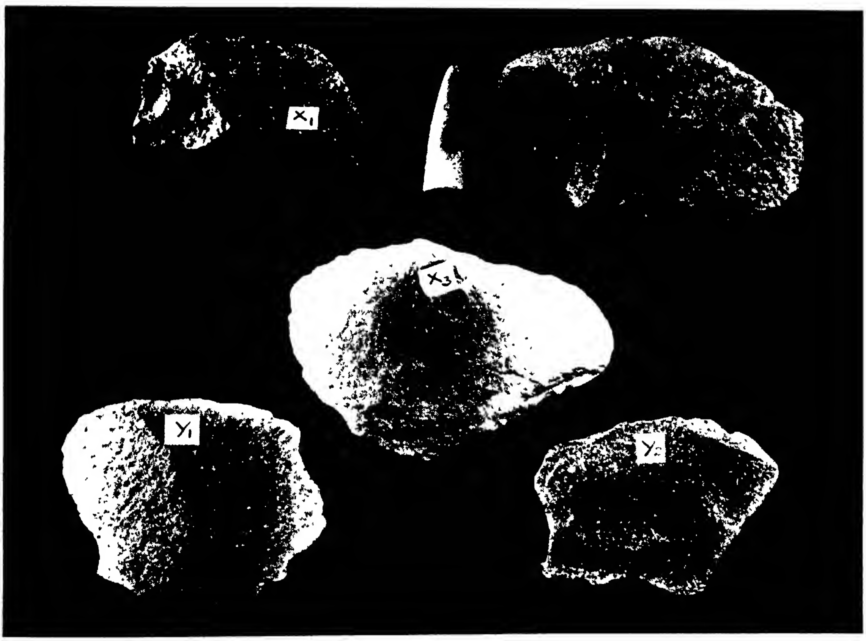

W1
W3
W5
W2

EXPLANATION OF PLATE XXXVIII.

Fig. 1. Crude choppers and massive scrapers.

Fig. 2. Reverse view.

$\frac{2}{5}$ natural size.



G. C. Clutton, photo.

A NEW GENUS, SPECIES, AND SUBSPECIES OF MARSUPIAL MICE (FAMILY DASYURIDÆ).

By

ELLIS LE G. TROUGHTON, Zoologist, Australian Museum.

(Plate xxxix.)

FROM time to time the Australian Museum has received small collections of mammals from Mr. F. L. Berney, of Queensland, which constitute very valuable additions to our material. Recently having occasion to check the identity of three pouched mice from the Richmond district, Queensland, presented by him in 1910, I found the specimens to be of unusual interest; one, which had been incorrectly relegated to *Phascogale minutissima,* proves to be a race of *Ph. ingrami*, providing the first record of the species' occurrence in Queensland, and warranting subspecific distinction, while the other two, belonging to the genus *Sminthopsis,* will be dealt with in another paper.

Since Thomas[1] described *Phascogale ingrami* from Alexandria, Northern Territory, Lönnberg[2] has described *Ph. subtilissima* from Noonkambah, Kimberley, north Western Australia. As both species, which are clearly differentiated by their characters and geographical range, exhibit an extraordinary flattening of the skull unique amongst marsupials, and described by Thomas as only equalled by four other mammals, three of which are bats, their retention within the genus *Phascogale* appears no longer justified. In a recent paper on the "External Characters of the Dasyuridæ," Pocock[3] says: "From the evidence supplied by the variation in the rhinarium, ears, marsupium, and other characters, it seems probable that *Phascogale* will prove to be divisible into several genera," and that "until more spirit preserved material than is now available comes to hand for examination and comparison, it will be wiser to leave the genus in its present somewhat chaotic state."

While a critical examination of the spirit collection of pouched mice was being made, a specimen collected by the late Richard Helms during the floods on the Darling in 1890 was found which has the skull flattened in a manner similar to the above species and characters necessitating its description as new. There now exist at least three species clearly differentiated by the marked

[1] Thomas.—Proc. Zool. Soc., 1906, p. 541, pl. xxxvii, fig. 2.
[2] Lonnberg.—Kungl. Sv. Vet. Akad. Handl., lii, 1, 1913, p. 9.
[3] Pocock.—Proc. Zool. Soc., 1926, p. 1082.

flattening of their skulls from *minutissima,* the only normal skulled *Phascogale* approximating their extremely small size. Being convinced that generic distinction is indicated, I propose to form a genus for the reception of the flat-skulled pouched mice which will serve to lessen the chaos referred to by Pocock. The genus may be briefly diagnosed as follows:

PLANIGALE, *gen. nov.*

Related to *Phascogale* but differentiated by the marked flattening of the upper surface of the skull (Pl. xxxix, figs. 1*c* and 2*c*), the height in front of the bullæ, from base to crown in profile, ranging from 3–3·5 mm., as compared with 4·7 in a skull of *Phascogale minutissima,* otherwise but little larger. Size small, even slightly less than that of *minutissima,* the smallest of the allied genus; the combined length of molars$^{1-3}$ not exceeding 3·2 mm. as opposed to 3·6 in an adult female *minutissima,* and the hindfoot ranging from 8·5 to 10, against 10·4 to 11·2 mm.

Rhinarium (Pl. xxxix, figs. 1*e-f* and 2*e-f*) simple in the species available to me, the median groove extending from the lip to the posterior border above; of the general shape figured by Pocock (*loc. cit.* text fig. 28) for *Ph. penicillata,* but without the definitely formed philtrum or traces of lateral grooves. Hallux present and clawless. Palms and soles naked and granulated; the central areas of the pads smooth and not striated. Tail short-haired, not tufted or incrassated. Mammæ variable in number.

Skull.—Remarkably flattened, with an almost straight dorsal profile. Interorbital region flat, with unridged edges; occipital crests almost obsolete. Nasals broadly expanded in their posterior half. Zygomata evenly convex outwards. Anterior palatine foramina not extending past centre of canines. Anterior portion of bullæ considerably larger than posterior.

Dentition.—Teeth of the normal number found in the allied genera *Phascogale* and *Sminthopsis,* except in *subtilissima,* in which the lower secator (p_4) is absent.

Range.—North-western New South Wales, western Queensland, Northern and north Western Australia.

Genotype.—The form which I consider to be a subspecies of *ingrami,* which is described hereunder.

Other species, *subtilissima* of Lönnberg (*loc. cit.*) and a new species from north-western New South Wales, described in this paper.

PLANIGALE INGRAMI BRUNNEUS, *subsp. nov.*

(Pl. xxxix, figs. 1*a-h.*)

Similar to true *ingrami* but distinguished by its brown basal fur, comparatively longer tail, anterior palatine foramina extend-

ing to the level of the middle of the canines, definite posterior palatal vacuities, and the pm[1] being definitely smaller than the median premolar.

External characters.—Above, the general colour is a peculiarly speckled pale tawny-olive composed of the brown of the basal fur showing through the warm buff tips, over which is a wash of tawny-olive; basal two-thirds of fur of a definite shade of brown near light "mummy" (Ridgway),[4] the upper third warm buff, with a tipping of tawny-olive. The tawny-olive is darkest just in front of the eye, and on the crown, shoulders, and centre of the back. Snout, from the rhinarium to between the eyes, of a deep olive-buff. Upper surface of hands and feet a very light greyish-olive.

Below, the general colour is olive-buff, the hairs on the chin of that colour throughout, but from the neck to the pouch the basal half of the fur is a definite brown, somewhat lighter than the basal fur above; the upper half of the fur is olive-buff. Tail of the same shade of light greyish-olive as the feet.

Ears short and broadly rounded (Pl. xxxix, fig. 1*d*), the height about equal to the width; laid forward, in a spirit specimen, they do not reach the posterior canthus of the eye, but extend about three-quarters of the distance from the anterior ear-base. Anterior base of the ear broadly overfolded, the apex obtusely rounded, followed by a slight but definite emargination behind the apex, the rest of the margin broadly rounded to the outer base. Supratragus large and untwisted, oblong, the anterior margin convexly sloping backwards, the posterior edge straight or slightly concave; when the ear is erect the supratragus is directed slightly upwards. The anterior ridge (Pocock) is not clearly defined and is sinuously folded and attached by a strand above to the floor of the anterior passage. The median ridge which bounds the anterior passage below is much thickened and upstanding; bent sharply upon itself at the posterior end, it extends only a short distance inferiorly, terminating about opposite the middle of the posterior ridge ("c" of Pocock's diagrams), not extending to the level of the lower margin of the inferior cleft as in *Ph. minutissima*. Inside of ear evenly covered with longish pale hairs, which form crests on the two laminated areas, one above and one below the supratragus.

Rhinarium hairless and of a more simple form (Pl. xxxix, figs. 1*e-f*) than in any of the types figured by Pocock (*loc. cit.*) and apparently differing from them all in having the median groove traversing the entire vertical extent, from the edge of the lip to the hind margin above. As is shown by Pocock for *Ph. lorentzi* and *Antechinomys spenceri*, there are no lateral or other

[4] Ridgway.—Color Standards and Color Nomenclature, Washington, D.C., 1912.

grooves, but otherwise the rhinarium is quite differently shaped, as the philtrum is almost entirely suppressed, being merely indicated by the slight emargination of the rhinarium-sides and represented by a small projection on each side extending beyond the terminus of the median groove.

Manus and pes broad and fleshy, the granulations comparatively large and the pads unstriated.

Manus with six well developed pads, the four small inter-digital ones coarsely granulated and surmounted by large, smooth, rounded central areas constituting almost the entire pad. Both carpal pads are represented by smooth areas of a different shape and larger than those of the interdigital pads, oblong-ovate, the outer or ulnar pad being larger and somewhat expanded distally, but not markedly crescentic or horseshoe-shaped.

Pes (Pl. xxxix, fig. 1*g*) broad-soled distally, with six well developed unstriated pads, the granulations comparatively large and sparse. The three interdigital pads consist of a large, oval, central area embedded in a ring of coarse granules. Hallucal pad distinct from, but situated close to the inner metatarsal pad, which is considerably broader but only slightly longer than the hallucal pad; outer metatarsal pad subequal in length to the inner one.

Tail slender, evenly haired, not tufted or incrassated, and comparatively longer than in the typical *ingrami,* being six-sevenths the length of the head and body as opposed to three-quarters in the typical form.

Pouch (Pl. xxxix, fig. 1*h*) approximating the relatively large development attained in *Ph. minutissima,* where there is a thickened crescentically curved flap almost encircling the wide mammary area; this flap is very deep in front, gradually becoming shallower laterally and fading out posteriorly so that it is absent in the middle line behind. Mammæ 6.

Skull. (Pl. xxxix, figs. 1*a-c*).—Apparently quite similar to the typical subspecies in its marked flattening, even convexity of the zygomata, wide expansion of the posterior half of the nasals, flat unridged interorbital region, and almost obsolete occipital crests. It differs, however, in having comparatively broader nasals, and in the extension of the anterior palatal foramina beyond the level of the front of the canines to between the middle of those teeth; also in having two distinct posterior palatal vacuities,[5] which are situated opposite the inner corners of molars$^{2-3}$, their length equal to the outer length of m^3. The anterior palatal foramina are

[5] Presence or absence of posterior palatal vacuities does not seem a very reliable diagnostic character, as they are easily overlooked; in my specimens the vacuities were covered with a leathery film which came away when pierced, leaving clear-cut openings.

very broad, their length being 1·5 and their combined breadth 1·3 mm. The hinder margins of the short premaxillæ rise rather abruptly, joining the nasals about 2 mm. from their tips.

Dentition.—Similar to that of the typical subspecies, but the p^1 is barely two-thirds the size of the median p^3 instead of being subequal to it as described by Thomas for his *ingrami.*

Dimensions of the holotype, preserved in spirit: Head and body, 65 mm.; tail, 57; hindfoot, 9; ear, from crown 6·5, from external base 8·5.

For cranial dimensions see table on p. 288.

Holotype.—Adult female, number M.2174 in the Australian Museum collection; associated with it is one young one with a total length of 46 mm. Donor F. L. Berney.

Hab.—Wyangarie, on the Flinders River, Richmond district, northern Queensland.

PLANIGALE TENUIROSTRIS, *sp. nov.*

(Pl. xxxix, figs. 2*a*-*g*.)

Of sombre colouration, the species is readily distinguished from *subtilissima* by its shorter tail and its dentition, and from *ingrami* by its more slender dimensions, darker colouration, and the comparatively marked narrowness of the nasals and elongation of the premaxillæ. From both allies it is distinguished by the narrower interorbital region.

External characters.—Above, the general colouration is darker than in *ingrami*, and more markedly speckled than in the *i. brunneus* form owing to the basal fur being darker, and the upper fourth lighter, with a tipping of black. The basal fur is unusually dark in spite of long preservation in spirit, about "blackish-brown 3" of Ridgway; the light upper fourth is near pinkish buff. Top of head, from rhinarium to between the ears, lighter than the back, about buffy brown, pencilled with darker brown hair-tips. There is a blackish whisker-mark along the lip from rhinarium to eye. Upper surface of hands and feet about tilleul-buff. Fur of under-surface somewhat lighter basally than that of the back, about fuscous. Hairs from chin to angle of jaws not parti-coloured and a shade of tilleul-buff; tips of fur from neck to vent pale olive-buff.

Ear (Pl. xxxix, fig. 2*d*) similar in general outline, but comparatively larger than in *ingrami brunneus*, reaching slightly beyond the posterior canthus of the eye when laid forward in a spirit specimen; without the definite emargination below the broadly rounded apex, and with a sharply defined triangular notch in the lower fourth of the margin which is not present in *i.*

brunneus. All the ridges are less pronounced than in *i. brunneus,* while the median ridge is not so sharply curved posteriorly, though it has a tendency to continue inferiorly to a level with the posterior end of the inferior cleft, as shown by Pocock for *Ph. minutissima.* The supratragus is shorter and more evenly convex than in *i. brunneus,* the antero-posterior length being 2·4 as opposed to 3 mm. in the latter form.

Rhinarium (Pl. xxxix, figs. 2*e*-*f*) very similar to that of *ingrami,* excepting that the inferior third is more elongate and its sides more concave, the suggestion of a philtrum being thus slightly more pronounced. The nostrils are more circular in outline than in the allied species.

Manus and pes not so broad and fleshy and with comparatively smaller granulations than in *i. brunneus,* but with a similar arrangement of unstriated central areas which are somewhat differently shaped.

Manus with six well developed pads, the four interdigital ones larger than in *i. brunneus,* the granulations smaller and more profuse, and the smooth rounded central areas constituting about half the area of the pad, instead of almost the entire pad as in the subspecies of *ingrami.* The two carpal pads are larger and more flattened than in the subspecies under comparison; the outer is the larger and the granules of the general surface encroach somewhat on the inner side proximally, tending to a hooked appearance of the central area anteriorly.

Pes (Pl. xxxix, fig. 2*g*) differing from that of *i. brunneus* in being decidedly narrower distally, in the greater elongation of the six well developed pads, and the finer and more profuse granulations on the sole. The smooth areas of the three interdigital pads embedded in finely granulated cushions, instead of forming almost the entire pad. Length of hallucal pad varying in a single individual; on one side it is smaller and separated by a decided space from the metatarsal pad, while on the other foot, though distinct, it is separated only by a slight groove from the metatarsal pad. The inner metatarsal pad is much longer, and narrower, than in *i. brunneus,* being about twice as long as the hallucal pad instead of almost subequal to it.

Tail slender, evenly haired, not tufted or incrassated, and three-quarters the length of the head and body.

Pouch with the well developed flap of skin encircling the mammary area in front and at the sides as figured for *i. brunneus* (Pl. xxxix, fig. 1*h*), but differing in possessing 10 or 12 mammæ instead of 6; on the left there are six clearly discernible, while on the right there are only five. Careful examination suggests that five on each side is probably the normal formula, for, although

Thomas considers it more likely that a teat would be suppressed than an additional one grown, the crowding of the anterior nipples on the side bearing six indicates that the extra one may be an abnormality, the other row of five nipples being quite normal in appearance.

Skull (Pl. xxxix, fig. 2*a-c*).—Similar in general appearance to that of *ingrami*, but of narrower proportions and comparatively a little less flattened, the height from base to crown in front of the bullæ being 3·5 mm. as compared with 3·3–3·4 in *ingrami*; nevertheless it is remarkably flattened in comparison to the height of 4·7 given by Thomas for a specimen of *Phascogale minutissima* of similar size. The nasals are decidedly longer and narrower than in *ingrami*; their greatest width only equals that of the nasals of the much smaller *subtilissima* in which their length is only 5 mm., as compared with 6·9 in this species. The comparative narrowness of the skull is further indicated by the lesser width of the interorbital region and braincase, and the narrower palatal foramina; the greatest combined width of the anterior palatal foramina is 1 mm. as opposed to 1·3 mm. in the holotype of *i. brunneus,* though the foramina lengths are the same. The premaxillæ are decidedly more elongated than in *i. brunneus,* their hind margins rising obliquely backward to a point about 2·6 mm. from the tips of the nasals.

Dentition.—Much as in *ingrami,* but with the p^4 of a different shape, considerably shorter antero-posteriorly, higher, and without the elongated posterior heel or talon present on that tooth in the allied species. The two anterior upper premolars are not subequal as in the typical *ingrami*, p^1 being about two-thirds the size of p^3 as in *ingrami brunneus*.

Dimensions of the holotype, preserved in spirit: Head and body, 67·5 mm.; tail, 50·5; hind foot, 9; ear, from crown 6, from external base 8·9.

For cranial dimensions see table on p. 288.

Holotype.—Apparently adult female, number M.3856 in the Australian Museum collection, which, with a three-quarter grown female, M.3857, was collected by the late Richard Helms.

Hab.—Collected at Bourke or Wilcannia, New South Wales, during the Darling River floods, in May or June, 1890.

ACKNOWLEDGMENTS.

I desire to express my appreciation of Mr. Berney's efforts as a collector, which have enabled me to record for the first time the

occurrence of a race of flat-skulled marsupial mice in Queensland, and my indebtedness to Miss Joyce K. Allan for the drawings illustrating this paper.

EXTERNAL MEASUREMENTS OF THE SPECIES AND SUBSPECIES OF *Planigale*.

	ingrami ingrami ♂	*ingrami brunneus* ♀	*tenuirostris* ♀	*subtilissima* ♂
Head and Body	80	65	67·5	45
Tail	60	57	50·5	51
Hindfoot	10	9	9	8·5
Ear, from crown[6]	—	6·5	6	6
Ear, from post. base ...	9	8·5	8·9	—

CRANIAL MEASUREMENTS OF THE SPECIES AND SUBSPECIES OF *Planigale*.

	ingrami ingrami ♂	*ingrami brunneus* ♀	*tenuirostris* ♀	*subtilissima* ♂
Greatest median length ...	18	16·7	—	15·5
Basal length	17	15·8	16·5	14·5
Zygomatic breadth ...	9·7	8·9	—	8·4
Length of nasals	6·6	6·3	6·9	5
Breadth of nasals	3	3·1	2·6	2·6
Interorbital breadth ...	3·8	3·8	3·5	4
Breadth of braincase ...	8·5	8·3	8	7·3
Palate length	8·7	8·1	8·7	7
Length of upper tooth-row	8	7·4	7·9	7
Length of lower tooth-row	7·2	7	6·8	6·5
Length of molars[1-3] ...	3·1	3·2	3·2	—
Depth of skull in front of bullæ	3·3	3·4	3·5	3

[6] It is not clear from which point the ear measurements of *i. ingrami* and *subtilissima* have been taken, though comparison with dimensions taken by myself suggest that the former is from the posterior base, and the latter from the crown as adopted in the British Museum catalogue dimensions by Thomas.

NOTES ON SOME REPTILES AND BATRACHIANS FROM THE NORTHERN DIVISION OF PAPUA, WITH DESCRIPTIONS OF NEW SPECIES OF *APISTHOCALAMUS* AND *LYGOSOMA*.

By

J. R. Kinghorn, C.M.Z.S.,
Zoologist, The Australian Museum, Sydney.

This paper is based on a small collection of reptiles and batrachians collected by Mr. C. T. McNamara in the Mount Lamington district, Northern Division, Papua, during August and September, 1927, and presented to the Trustees of the Australian Museum, Sydney. The following is a list of the species collected:—

BATRACHIA.

Hyla nasuta *Gray*.

One typical specimen.

Hyla infrafrenata *Günther*.

Two very large specimens were collected, and some of their characters suggest such a close affinity to *Hyla spengeli* Boulenger, that in all probability an examination of a larger series of these two species would show them to be synonymous. These two *Hylas* together with the following four: *H. sanguineolenta, H. humeralis, H. militaria,* and *H. aruensis,* form a most interesting group, and a very closely allied one, but unfortunately there is not a large enough series in the Museum collection to enable any work to be done regarding their status.

Hylophorbus *sp.*

Several specimens which appear to belong to this genus were sent by Mr. McNamara to the Sydney University and were later submitted to me for identification. Before their identity can be determined, a closer examination of the skeletal characters will have to be made, and I have requested Mr. McNamara to collect some more specimens for dissection purposes. There appears to be little doubt that it will prove to be a new species.

OPHIDIA.

Enygrus asper *Günther*.

A well marked, medium sized specimen, having 36 scales round the body and 17 rows of subcaudals.

Enygrus carinatus *Schneider.*

Two specimens typically marked, and with the following scale rows: (A), 39 scales round the body, 31 subcaudals; (B), 36 scales round the body, 39 subcaudals.

Chrondropython viridis *Schlegel.*

A beautifully marked specimen 500 mm. in length, of which the tail measures 95 mm., and tapers away to an extremely fine point. The rostral is deeper than broad and bears two deep pits. The first three upper labials are pitted and the 7th and 8th enter the eye. There are sixteen lower labials, the 8th to 13th pitted. Scales in 67 rows, 16 subcaudals. The colour (in spirits) is vivid yellow with chocolate brown spots and cross markings.

Dendrophis calligaster *Günther.*

One typical specimen measuring 680 mm.

Dipsadomorphus irregularis *Merrem.*

Three specimens, two of which are young and measure 380 and 410 mm. The adult specimen has 21 rows of scales, the internasals are only slightly broader than long, the frontal longer than broad and the posterior chin shields are longer but not larger than the anterior.

Apisthocalamus lamingtoni *sp. nov.*

(Figure 1.)

Snout short, broadly rounded. The distance from the eye to the rostral less than the distance between the eyes. Rostral a little broader than deep, the portion visible from above measuring about one-third its distance from the frontal. Internasals broader than

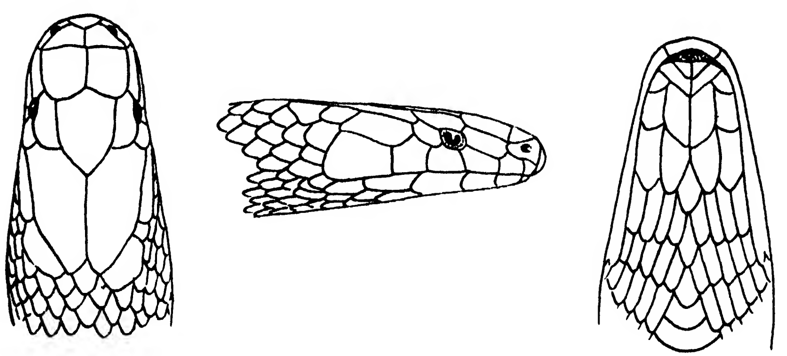


Figure 1.

long, one-half as long as the prefrontals, the latter being longer than broad. Frontal longer than broad, not as long as its distance from the end of the snout, nearly twice as broad as the supraocular, much shorter than the parietal. One postocular, one preocular, the latter twice as long as deep, oblique and in contact with the posterior nasal. Temporals 1 + 2, the anterior one being long and narrow, extending as far back as the posterior border of the sixth upper labial. The lower posterior temporal is very little larger than the surrounding scales. Nostril pierced between two nasals. Six upper labials, the third and fourth entering the eye. Six lower labials, the first pair forming a suture behind the mental, the first four in contact with the anterior chin-shields, which are larger than the posterior.

Scales smooth, in 15 rows. Anal single. Ventrals rounded, 173. Subcaudals in 46 pairs, plus a spine-like one on the tip of the tail. Total ventrals and subcaudals, 219.

Colour (in spirits): Blackish brown above, yellowish below. Lower labials mottled with brown, the fifth and sixth upper labials yellowish on the lower half. Subcaudals yellowish anteriorly, the posterior ones being dark with yellow edges. Total length 420 mm., tail 78 mm.

Holotype in the Australian Museum, registered number R 9351.

Two very young specimens do not vary from the holotype except that the frontal is somewhat squarer, this being due to the young specimens being more symmetrical. In colour marking there is a striking difference; there is a conspicuous yellowish nuchal collar, as in some species of *Pseudelaps,* there being more "collar" in the smaller specimen. The following are the respective measurements: (A), 190 mm., 15 scale rows, 1 anal, 186 ventrals, 30 paired subcaudals, total 216; (B), 165 mm., 15 scale rows, 1 anal, 193 ventrals, 28 paired subcaudals, total 221.

Registered number, R 9352.

All the specimens are from the Mount Lamington district, Northern Division, Papua.

LACERTILIA.

Lygosoma loriae *Boulenger.*

This species was described from three specimens collected at Moroka, S.E. New Guinea, in 1889-1892. As very few have been discovered since, it might be considered a rare species, and I am fortunate in having four specimens in the collection before me. It is a typical mountain form, the types being collected 2,300 feet above sea level in the Bartholomew Range. There are slight variations from the original description, as might be expected. Two small

specimens, 75 mm. in length, are typical, but the two large ones vary somewhat; in one the prefrontals are separated, in the other they form a short suture, and there are several enlarged scales (nuchals) bordering the parietals. In other characters and colour markings these agree perfectly with published descriptions of the species.

LYGOSOMA IRIDESCENS *Boulenger.*

Two specimens are in the collection.

LYGOSOMA MUELLERI *Schlegel.*

Mr. McNamara informs me that the native name for this species is "Omu."

I have two specimens from Mount Lamington, measuring about 380 mm. from snout to tip of tail. They are intermediate in colour between *L. muelleri* and *L. muelleri* var. *latifasciatum* Meyer. The general body colour and markings are those of the former, while the sides of the tail are barred alternately with yellowish and brown. The face, chin, and throat are blackish, as also are the palms of the hands and feet. The fronto-nasal shield is broader than long, forming a narrow suture with the rostral and just tipping the frontal.

LYGOSOMA (LIOLEPISMA) PAPUAE *sp. nov.*

(Figure 2.)

Lower eyelid with a transparent disk. Ear opening vertical, smaller than the eye opening and without lobules. Nostril in a large nasal, no supranasals. Fronto-nasal broader than deep, in contact with the rostral. Prefrontals forming a suture on the median line. Frontal V-shaped, longer than broad, longer than its

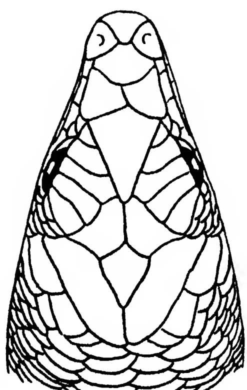


Figure 2.

distance from the end of the snout. Fronto-parietals and interparietal distinct, all about equal in size. Parietals in contact posteriorly. Six supraoculars, the first three joining the frontal shield. Nine supracilliaries. Two pairs of nuchals or enlarged scales bordering the parietals. Eight upper labials, the sixth below the eye. Body scales smooth, in 36 rows, dorsals enlarged. Anals hardly enlarged. The forelimb stretched forwards reaches the eye, the adpressed limbs meet. The distance between the snout and the forelimb is contained once and one-third between the axilla and the groin. Digits compressed laterally, with 21 lamellæ under the fourth toe.

Colour: Dark brown above, with irregular, thin, wavy, cross bands, many of which are broken in the centre. The sides of the head, lips and body are mottled with lighter colour. There are fourteen crossbands between the head and the tail, and seventeen on the tail.

Holotype from Mount Lamington district, Northern Division, Papua; Australian Museum registered number R 9357.

VARANUS INDICUS *Daudin*.

A well marked young specimen, with no variation from the typical. Total length 480 mm., tail 280 mm.

GYMNODACTYLUS PELAGICUS *Girard*.

Two specimens typical in all structural characters, but extremely dark brown in colour, with almost black angular markings on the dorsal surface.

FISHES FROM THE GREAT BARRIER REEF COLLECTED BY MR. MELBOURNE WARD.

By

GILBERT P. WHITLEY, Ichthyologist, Australian Museum.

(Figures 1-2.)

A collection of fishes made by Mr. Melbourne Ward in November, 1927, amongst the islets of the Bunker Group, Queensland, is a small one, but contains several interesting species. Hoskyn, Lady Musgrave, and Fairfax Islands were visited; these are situated at the southern extremity of the Great Barrier Reef. I have already given an account[1] of the fishes of the adjacent Capricorn Group, which may be consulted for references to literature and notes which are not repeated here. Several species of fishes have, however, been recorded from those islands since the appearance of my paper. These are: *Pseudochromis* (*Leptochromis*) *tapeinosoma* Bleeker from Masthead Island,[2] *Pomacentrus wardi* Whitley from Heron Island,[3] *Epinephelus merra* Bloch, *Pomacentrus sufflavus* Whitley, and *Glyphisodon hedleyi* Whitley from North-West Islet,[4] and *Petroscirtes grammistes* C. & V. (of which *P. lineatus* De Vis is a synonym) from Masthead and North-West Islets.[5]

Family PSEUDOCHROMIDÆ.

Genus DAMPIERIA *Castelnau*, 1875.

Cichlops Müller and Troschel, Horæ Zoologicæ iii, 1849, p. 24. Orthotype, *C. microphthalmus* (*fide* Jordan, Gen. Fish. ii, 1919, p. 243). Preoccupied by *Cichlops* Gray, Cat. Birds Nepal, 1846, p. 77 (*teste* Mr. T. Iredale), previously introduced as *Cichlops* Gray, Zool. Misc., vi, June, 1844, p. 83, *ex* Hodgson, *nom. nud.*; a genus of birds.

Labracinus Schlegel, Handbuch der Dierkunde (v.d. Hœven), 1850. *Nomen nudum* (*fide* Gill, 1904).

Dampieria Castelnau, Res. Fish. Austr. (Vict. Offic. Rec. Philad. Exhib.), 1875, p. 30. Haplotype *D. lineata* Castelnau.

Labracinus Bleeker, Arch. Neérl. Sci. Nat., xi, 1876, p. 320. *Ex* Schlegel MS. Type, *Cichlops cyclophthalmus* Müller and Troschel (*fide* Jordan, Gen. Fish., iii, 1919, p. 383). Substitute for *Cichlops* Müller and Troschel.

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[1] Whitley.—Austr. Zool. iv, 4, 1926, pp. 227-236, pls. xxxiii-xxxiv, and text-fig. 1.
[2] McCulloch.—Biol. Res. Endeavour, v, 4, 1926, p. 192, pl. ii.
[3] Whitley.—Rec. Austr. Mus. xv, 5, 1927, p. 301, text-fig. 1.
[4] Whitley.—Rec. Austr. Mus. xvi, 1, 1927, pp. 1-32, pl. i, and text-fig. 1.
[5] Whitley.—Rec. Austr. Mus., xvi, 4, 1928, p. 229.

Labracinus Gill, Proc. U.S. Nat. Mus., xxviii, 1904, p. 119.

Dampieria Ogilby, Ann. Qld. Mus., No. 9, 1908, p. 35.

Dampieria *Jordan*, Tanaka, and Snyder, Journ. Coll. Sci. Imp. Univ. Tokyo, xxxiii, 1913, p. 188.

I have no record of any definition of *Labracinus* before 1875, so it seems preferable to use *Dampieria* as the generic name to supersede *Cichlops*, preoccupied.

Dampieria lineata *Castelnau.*

Dampieria lineata Castelnau, Res. Fish. Austr. (Vict. Offic. Rec. Philad. Exhib.), 1875, p. 30. Dampier's Archipelago, N.W. Australia. Type in Paris Museum.

Cichlops lineatus Waite, Rec. Austr. Mus., iv, 5, 1902, p. 191, pl. xxxi.

One young specimen from Lady Musgrave Island. This species, which is only known from a few specimens, has not hitherto been recorded from Queensland.

Scorpænodes guamensis (*Quoy and Gaimard*).

Scorpæna guamensis Quoy and Gaimard, Voy. "Uranie" and "Physicienne," Zool., 1824, p. 326. Guam.

A specimen from Lady Musgrave Island has the characteristic black spot on the operculum as mentioned in the original description.

Halichores trimaculatus (*Griffith*).

Julis trimaculata Griffith, Anim. Kingdom (Cuvier), x, 1834, pl. xlv, fig. 2. Name and fig. only [*Ex* Quoy and Gaimard MS.]. *Id.* Quoy and Gaimard, Voy. "Astrolabe," Zool., iii, 1835, p. 705, pl. xx, fig. 2. Vanikoro, Santa Cruz Is. *Id.* Cuvier and Valenciennes, Hist. Nat. Poiss., xiii, 1839, p. 452.

Halichœres trimaculatus McCulloch, Rec. Austr. Mus., ix, 3, 1913, p. 385.

One from Fairfax Island.

Family POMACENTRIDÆ.

A proposed revision of the Australian Pomacentridæ is anticipated by the declaration of the following new names.

Demoisellea, *gen. nov.*

Furcaria Poey, Memorias hist. nat. Cuba ii, 1860, p. 194. Orthotype, *F. puncta* Poey = *Heliases multilineatus* Guichenot (*fide*

Jordan and Evermann, Bull. U.S. Nat. Mus., xlvii, 2, 1898, p. 1547).

Furcaria Poey, 1860, is preoccupied by *Furcaria* Lesson, 1838, a genus of birds.[6] *Demoisellea* is offered as a substitute, with *Furcaria puncta* Poey as orthotype.

IREDALEICHTHYS, *gen. nov.*

Chrysiptera Swainson, Nat. Hist. Classif. Fish. Amphib. Rept., ii, July, 1839, pp. 171 and 216. Logotype, *Chrysiptera azurea* Swainson [= *Glyphisodon azureus* Quoy and Gaimard], selected by Swain, Proc. Acad. Nat. Sci. Philad., 1882 (1883), p. 273.

Swainson's name was emended to *Chrysoptera* by Agassiz in the Nomenclator Zoologicus. It is, however, regarded as being preoccupied by *Chrysopterus* Swainson, 1836, a genus of birds,[7] and by *Chrysoptera* Zincken, 1817, a genus of Lepidoptera.[8] In honour of Mr. Tom Iredale, who has frequently given me the benefit of his advice in matters of taxonomy, I name *Iredaleichthys*, with *Chrysiptera azurea* Swainson, as orthotype.

AGRIPOPA, *gen. nov.*

Onychognathus Troschel, Arch. Naturg. (Weigmann), 1866, p. 231. Orthotype, *O. cautus* Troschel (*fide* Jordan, Gen. Fish., iii, 1919, p. 343).

Troschel's name is preoccupied by *Onychognathus* Hartlaub, 1859, a genus of birds,[9] and I designate *Agripopa* to replace it. I have not seen the original definition of this genus by Troschel.

In Jordan's "Classification of Fishes," there is included in the family Pomacentridæ, doubtless through inadvertence, the genus *Jerdonia* Day, 1870. This name is preoccupied by *Jerdonia* Blanford, 1862, a genus of molluscs,[10] and applies to a Loach. *Enobarbus* is proposed as a substitute for *Jerdonia* Day.

ZABULON, *gen. nov.*

The fish from off Ki Islands named *Heliastes roseus* by Günther[11] differs in so many respects from *Heliases insolatus*

[6] Lesson.—Compl. de Buffon ed. 2, ii, 1838, p. 373.
[7] Swainson.—Classif. Birds, i, Oct., 1836, p. 69.
[8] Zincken.—Allg. Lit. Zeit. iii, 1817, p. 75 (*fide* Sherborn, Index Animalium).
[9] Hartlaub.—Journ. f. Ornith. (Cabanis), vii, 1859, pp. 2 and 35.
[10] Blanford.—Journ. Asiat. Soc. Bengal xxx, 1861 (1862), p. 351; Ann. Mag. Nat. Hist. (3), xiii, 1864, p. 448.
[11] Günther.—Rept. Voy. "Challenger," Zool. i, 6, 1880, p. 45, pl. xx, fig. D.

C. and V.[12], the logotype of *Heliases*, that I designate it the orthotype of a new genus, *Zabulon*, characterized by having three anal spines and the lateral line running along the upper portion of the sides. No dental characters are given by Günther, but the rounded caudal, elongate body, and large eyes appear to be distinguishing features of *Zabulon roseus*.

POMACENTRUS DARWINIENSIS, *sp. nov.*

Dascyllus fasciatus Macleay, Proc. Linn. Soc. N.S. Wales, ii, June, 1878, p. 361, pl. x, fig. 2. Port Darwin, North Australia. Not *Pomacentrus fasciatus* C. and V., 1830.

Dascyllus fasciatus Macleay is a *Pomacentrus*, so Macleay's name is preoccupied by *Pomacentrus fasciatus* Cuvier and Valenciennes.[13] I therefore propose *P. darwiniensis* as a substitute name.

The type is preserved in the Macleay Museum, University of Sydney, and has the following characters:—D.xiii/13; A.ii/13. About 25 transverse rows of scales. L. lat. with 16-18 tubes. Preorbital entire. Preoperculum strongly denticulated. Teeth compressed, in a single series. A dark spot on the posterior part of the spinous dorsal, and a smaller one similarly situated on the soft portion.

POMACENTRUS FLAVICAUDA, *sp. nov.*

(Fig. 1.)

Pomacentrus chrysurus Alleyne and Macleay, Proc. Linn. Soc. N.S. Wales, i, March, 1877, p. 343. *Id.* Schmeltz, Cat. Mus. Godef., vii, 1879, p. 52. *Id.* McCulloch and Whitley, Mem. Qld. Mus., viii, 1925, p. 166. *Id.* Whitley, Austr. Zool., iv, 1926, p. 230. *Id.* Paradice and Whitley, Mem. Qld. Mus., ix, 1927, p. 96. *Id.* Whitley, Rec. Austr. Mus., xvi, 1927, p. 20. Queensland and North Australia. Not *P. chrysurus* Cuv. and Val., 1830; *vide infra.*

D.xiii/15; A.ii/16; P.17; V.i/5; C.14. Sc.26. L. tr. 3/1/9. 19 tube-bearing scales on the lateral line plus about 7 punctured scales.

Head (18 mm.) 3·1 in length to hypural joint; depth (28) 2 in same. Snout (5) equal to interorbital width (5), slightly shorter than the eye (6), which is 3 in head. Least depth of caudal peduncle (8) 8·7 in length to end of middle caudal rays (70).

Head scaly, excepting on suborbital and snout. Pores are scattered over the upper and lower surfaces of the head and are

[12] Cuvier and Valenciennes.—Hist. Nat. Poiss, v, 1830, p. 494, pl. cxxxvii.
[13] Cuvier and Valenciennes.—Hist. Nat. Poiss v, 1830, p. 426, pl. cxxxiv.

particularly noticeable before the eye on the preorbital. Suborbital irregularly but strongly denticulated, with a deep notch. Other opercles entire, except for the ascending limb of the preoperculum which is strongly serrated. Opercular spine present. Interorbital slightly convex. Maxillary almost reaching vertical of anterior margin of eye. A single series of compressed incisors in each jaw.

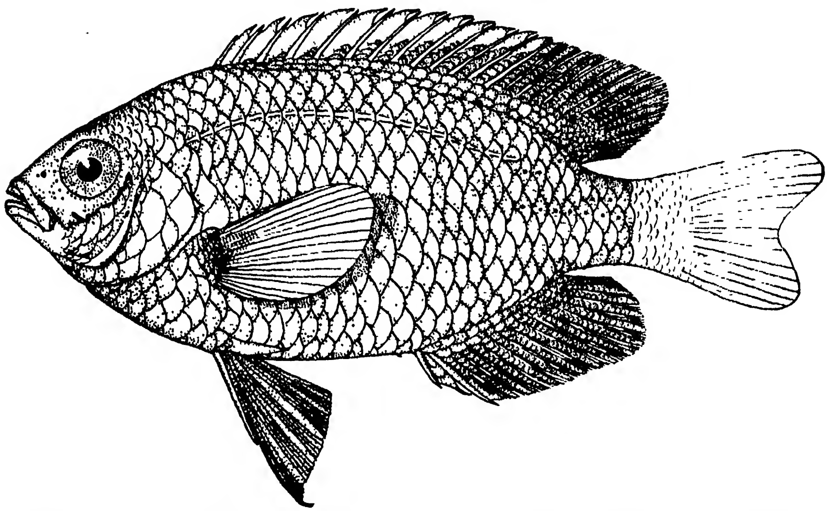

Figure 1.—*Pomacentrus flavicauda*, sp. nov. Holotype from North-West Islet, Queensland.

Body ovate, compressed, covered with large scales which extend over the isthmus and fins. Punctured scales below and behind the termination of the tube-bearing lateral line.

Dorsal originating slightly behind the vertical of the pectoral origin, and terminating slightly behind the posterior insertion of the anal. Fins, including caudal lobes, rounded.

Colour (*in alcohol*).—Head and body fairly uniform chocolate-brown as far as the caudal peduncle, where the brown finishes abruptly and gives place to the bright yellow of the tail, the sub-vertical junction of the colours being immediately anterior to the hypural joint. Dorsal greyish-brown, darker near the pencils of the membranes. Ventrals and anal similar to body-colour. Pectorals yellowish, with a very small axillary blotch.

Described and figured from the holotype, 70 mm. in length to the end of the middle caudal rays. North-West Islet, Capricorn Group, Queensland; coll. G. P. Whitley, 1925. Australian Museum regd. no. IA.2598.

Variation.—In a series of spirit specimens, the ground-colour varies from light to dark brown, but the yellow tail is always well differentiated from it. In some, there are whitish flecks on the suborbitals and cheeks, an opercular spot is sometimes present, and the axillary blotch of the pectoral is occasionally well marked. Small specimens have a black ocellus, edged with white, on the dorsal rays; this appears to recede posteriorly until it disappears with age, though it may be present or absent in small specimens of equal size, accompanied or unaccompanied by white dots along the scale-rows of the body. The soft dorsal and anal fins may be rounded or somewhat pointed. Some specimens are slightly deeper or more robust than others.

Young.—A specimen from Michaelmas Cay, north Queensland, is only 17 mm. long, yet possesses the distinctive brown and yellow colours. The ocellus on its soft dorsal touches the back. Dorsal spines comparatively high; squamation well developed; preopercular and suborbital margins smooth.

Localities.—Specimens in the Australian Museum are from the following localities:—North Australia: Melville Island (Dr. G. C. P. Courtney). Queensland: North-West Islet, Capricorn Group (G. P. Whitley—holotype); Fairfax Islet, Bunker Group (M. Ward); St. Crispin Reef, off Port Douglas, and Cairns Reef, off Cooktown (A. R. McCulloch); Maori, Feather, and Coates Reefs, due S.E. of Cairns (Dr. W. E. J. Paradice); Michaelmas Cay, off Cairns (C. Hedley, T. Iredale, and G. P. Whitley).

Affinities and taxonomy.—The new species is superficially like *Pomacentrus delurus* Jordan and Seale[14] from the Philippine Islands, but has different fin-counts and a denticulated suborbital.

Pomacentrus flavicauda is the Australian species hitherto regarded as *Pomacentrus chrysurus* Cuvier and Valenciennes, but reference to the original description[15] indicates that the fish examined probably had a misplaced label. Cuvier and Valenciennes describe it as fairly uniform brown and note that Broussonet's name, *Chætodon chrysurus*, which they evidently took from the label only, suggests that the fish had a yellow tail. The present species, *P. flavicauda,* retains the yellow tail in any state of preservation. It seems, therefore, necessary to reject Cuvier and Valenciennes' name in this connection as, apart from the fact that the name *Chætodon chrysurus* (Brouss.) C. and V. is preoccupied, as will be shown later on, there are many species of Pomacentridæ of fairly uniform brown colour and with denticulated suborbitals from "Southern Seas."

I here give a translation of Cuvier and Valenciennes original description of *Pomacentrus chrysurus*:—

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[14] Jordan and Seale.—Proc. U.S. Nat. Mus., xxviii, 1905, p. 783, fig. 6.
[15] Cuvier and Valenciennes.—Hist. Nat. Poissons v, 1830, p. 423.

The late Broussonnet left in the collection which he bequeathed to the Faculty of Medicine at Montpellier, a Pomacentrid from the Southern Sea, which he called *Chætodon chrysurus* and which has the suborbital as in the two preceding species. [*i.e.*, "sensiblement dentelé" in *Pomacentrus vanicolensis*, "presque aussi fortement dentelé" in *P. emarginatus*.] Its general form is a little more oblong. D.13/15; A.2/15, etc. In preservative, it appeared a fairly uniform brown. From the name which Broussonnet gave it one judges that the caudal was yellow. It is three inches long.

The following is the synonymy, as far as I have been able to determine, of *Pomacentrus chrysurus, sensu stricto*:—

(*Chætodon*) *chrysuri* Gmelin, Syst. Nat. (Linnæus), ed. 13, i, 3, 1789, p. 1269, footnote. *Ex* Broussonet MS. *Nomen nudum*, in genitive case. No locality.

Pomacentrus chrysurus Cuvier and Valenciennes, Hist. Nat. Poiss., v, July, 1830, p. 423. "La mer du Sud." *Ex Chætodon chrysurus* Broussonet MS. [Preocc. by *C. chrysurus* Bloch and Schneider, 1801 = *Holacanthus* (*Chætodontoplus*) *mesoleucus* (Bloch). Not *Chætodon chrysurus* Liénard, 1834 = *Chætodon mertensii* Cuv. and Val.] *Id.* Günther, Cat. Fish. Brit. Mus., iv, 1862, p. 29 (Amboina). *Id.* Günther, Fische der Südsee, vii (Journ. Mus. Godef., xv), 1881, p. 228, as synonym of *P. littoralis*. *Id.* Jordan and Seale, Bull. U.S. Bur. Fish., xxv, 1905 (1906), p. 281.

Chætodon chrysurus Day, Fish. India, 1877, p. 105. Queried refs. in synonymy only. The Pomacentrid is here confused with *Chætodon chrysurus* Liénard from Mauritius, which is *Chætodon mertensii* Cuv. and Val.

The name *Chætodon chrysurus* has been applied to at least three distinct species of fishes by early authors. Its first appearance was in Gmelin (1789) as a *nomen nudum ex* Broussonet MS. This is here regarded as synonymous with *Pomacentrus chrysurus* Cuv. and Val. (1830), which was also based on Broussonet's MS. But *Chætodon chrysurus* (Brouss.) C. and V., published in July 1830, was preoccupied by *Chætodon chrysurus* Bloch and Schneider (1801), whose status I shall discuss below. The third *Chætodon chrysurus*, whose authorship is by some attributed to Desjardins, is that of Liénard.[16] Of the three, the latter is the only true *Chætodon* as the genus is understood today, but its name is unfortunately preoccupied, and is apparently a synonym of *Chætodon mertensii* Cuv. and Val.[17]

I was surprised to find how the name *Chætodon chrysurus* Bloch and Schneider[18] had been ignored in subsequent literature. The original description agrees well with Bleeker's figure of *Holacanthus* (*Chætodontoplus*) *mesoleucus* in the "Atlas

[16] Liénard.—Proc. Zool. Soc. Lond., 1833 (1834), p. 117.
[17] Cuvier and Valenciennes.—Hist. Nat. Poiss. vii, April, 1831, p. 47.
[18] Bloch and Schneider.—Syst. Ichth., 1801, p. 228.

Ichthyologique," with which *Chætodon chrysurus* Bloch and Schneider is evidently conspecific. This was originally described by Bloch in his "Naturgeschichte der ausländischen Fische," a work whose first edition I am unable to consult. Sherborn gives no reference to *Chætodon mesoleucus* Bloch in the first volume of his wonderful compilation, the "Index Animalium," as he perhaps thought that it was the same as *Chætodon mesoleucos* Forskal,[19] which is a true *Chætodon*. As I do not regard Forskal's work as binomial, *Chætodon mesoleucus* Bloch is not, in my opinion, preoccupied by *C. mesoleucos* Forskal. The latter name was introduced binomially by Bonnaterre[20] in 1788, after Bloch's name had been published.

Chætodon chrysurus Bloch and Schneider should therefore apparently be called *Holacanthus* (*Chætodontoplus*) *mesoleucus* (Bloch), references and synonymy being as follows:—

Chætodon mesoleucus Bloch, Nat. ausl. Fische (not seen), and Ichtyologie vi, 1788, p. 88, pl. ccvi, fig. 2. "Japan" (Probably East Indies). *Id.* Bloch and Schneider, Syst. Ichth. 1801, p. 227. [Not "*Chætodon mesoleucos*" Forskal, 1775 = Bonnaterre, Tabl. Encycl. Meth. Ichth. 1788, p. 87 (*Chetodon*) = *Chætodon hadjan* Bloch and Schneider, 1801, p. 227.]

Chætodon mesomelas Gmelin, Syst. Nat. (Linnæus), ed. 13, i, 3, 1789, p. 1263. Based on Bloch's figure. "Japan."

Chætodon chrysurus Bloch and Schneider, Syst. Ichth., 1801, p. 228. No type-locality; I designate "East Indies." Not *Chætodon chrysurus* C. and V., 1830, nor Liénard, 1834.

Holacanthus mesoleucus Lacépède, Hist. Nat. Poiss., iv, 1802, pp. 528 and 537. *Id.* Günther, Cat. Fish. Brit. Mus. ii, 1860, p. 54.

Holacanthus mesoleucos Cuvier and Valenciennes, Hist. Nat. Poiss., vii, 1831, p. 170. Moluccas and Java. "Bloch pretend l'avoir reçue du Japon."

Chætodon atratus Gray, Cat. Fish. coll. Gronow Brit. Mus. 1854, p. 72. "India."

Chætodontoplus mesoleucus Bleeker, Atl. Ichth., ix, 1878, p. 56, pl. ccclxix, fig. 5. (Batavia, etc.).

It would perhaps be as well to ascertain here the correct name of the Red Sea *Chetodon mesoleucos* Bonnaterre, preoccupied (*vide supra*) by *C. mesoleucus* Bloch. I regard the name *Chætodon hadjan,* fortunately provided by Bloch and Schneider,[21] as available

[19] Forskal.—Descr. Animalium. 1775, p. 61.
[20] Bonnaterre.—Tabl. Encycl. Meth. Ichth., 1788, p. 90 (not p. 87).
[21] Bloch and Schneider.—Syst. Ichth., 1801, p. 227.

for this species. As *Chætodon mesoleucus*, this species has recently been redescribed from Red Sea specimens by Ahl.[22]

SUMMARY—

Chætodon chrysurus (Broussonet MS.) C. and V. = *Pomacentrus chrysurus* (C. and V.).

Chætodon chrysurus Bloch and Schneider = *Holacanthus* (*Chætodontoplus*) *mesoleucus* (Bloch).

Chætodon chrysurus Liénard = *Chætodon mertensii* C. and V.

Pomacentrus chrysurus Alleyne and Macleay, and Australian authors = *Pomacentrus flavicauda* Whitley.

Chætodon mesoleucus Bloch = *Holacanthus* (*Chætodontoplus*) *mesoleucus* (Bloch).

Chetodon mesoleucos (Forskal. non-binom.) Bonnaterre = *Chætodon hadjan* Bloch and Schneider.

ASTERROPTERIX SEMIPUNCTATUS *Rüppell.*

One from Fairfax Island, and one from Hoskyn Island.

EVIOTA VIRIDIS (*Waite*).

One from Hoskyn Island.

PARAGOBIODON ECHINOCEPHALUS (*Rüppell*).

Two from Hoskyn Island, four from Lady Musgrave Island, and one from Fairfax Island.

GOBIODON CERAMENSIS (*Bleeker*).

Gobius ceramensis Bleeker, Nat. Tijdschr. Ned. Ind. iii, 1852, p. 704. Ceram.

Gobiodon quinquestrigatus var. *ceramensis* McCulloch and Ogilby, Rec. Austr. Mus. xii, 10, 1919, p. 211.

Three from Lady Musgrave Island. In formalin, the colour is uniformly bright canary yellow.

PARAPERCIS CYLINDRICA (*Bloch*).

One specimen, Hoskyn Island.

TRIPTERYGION ATROGULARE *Günther.*

One from Fairfax Island.

[22] Ahl.—Arch. Naturg. (Weigmann), lxxxix, A, 5, 1923, p. 173.

SALARIAS RIVULATUS (*Rüppell*).

Salaris rivulatus Rüppell, Atlas zu Rüppell, Reise (Senckenb. Nat. Ges.), Fische, 1830 or 1831, p. 114. Tor, Red Sea.

Salarias rivulatus McCulloch and McNeill, Rec. Austr. Mus., xii, 2, 1918, p. 15, pl. iii, figs. 3-4.

One male, 122 mm., in total length, from Fairfax Island; a male and female from Lady Musgrave Island.

SALARIAS CRENULATUS PALLIDUS *Whitley*.

A male from Fairfax Island.

ECSENIUS MANDIBULARIS *McCulloch*.

One specimen from Hoskyn Island.

Family BROTULIDÆ.

Subfamily DINEMATICHTHYINÆ.

Genus DINEMATICHTHYS *Bleeker*, 1855.

Dinematichthys Bleeker, Nat. Tijdschr. Ned. Ind., viii, 1855, p. 318. Haplotype, *D. iluocœteoides* Bleeker, *ibid.*, p. 319. *Id.* Günther, Cat. Fish. Brit. Mus. iv, 1862, p. 374. *Id.* Goode and Bean, Oceanic Ichth., i, 1895, p. 314. *Id.* Jordan and Evermann, Fish. N. and Mid. America, iii, 1898, p. 2503. *Id.* Radcliffe, Proc. U.S. Nat. Mus., xliv, 1913, p. 137.

Diancistrus Ogilby, Abstr. Proc. Linn. Soc. N. S. Wales, 30 Nov., 1898 (publ. early Dec.), pp. ii and iii. "A brotulid near *Dinematichthys*." *Nomen nudum*. *Id.* Proc. Linn. Soc. N. S. Wales, xxiii, 1899, p. 743. Haplotype, *D. longifilis* Ogilby, *ibid.*, p. 744.

No barbels, cilia, or tubercles on head. Dorsal undivided. Caudal distinct. An opercular spine. Cheeks and body scaly. Teeth on jaws, vomer, and palatines.

DINEMATICHTHYS MIZOLEPIS *Günther*.

(Fig. 2.)

Dinematichthys mizolepis Günther, Ann. Mag. Nat. Hist. (3), xx, July 1, 1867, p. 66. Cape York, Queensland. Type in British Museum. *Id.* Whitley, Austr. Zool., iv, 1926, p. 236.

D.82; A.67; P.17; C.14. L. lat. c. 92; l. tr. c. 30.

This species seems close to the genotype, *D. iluocœteoides* Bleeker[23] from the East Indies, but may be regarded as distinct until comparisons of series of specimens may be made. *D. longifilis* Ogilby[24] from Lord Howe Island and *D. consobrinus* Hutton[25] from New Zealand, which have been figured by Waite[26] and Hector[27] respectively, and *D. piger* Alcock[28] from the Andaman Islands, have fewer fin-rays.

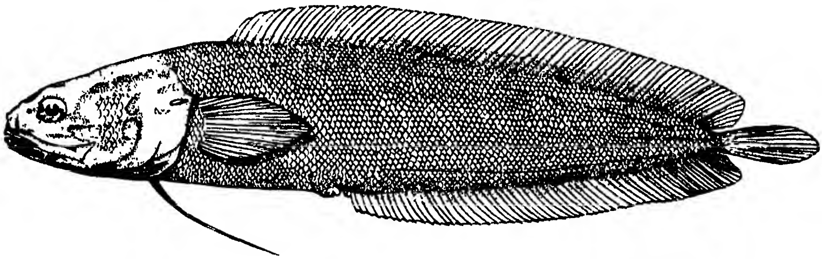


Figure 2.—*Dinematichthys mizolepis* Günther. Pleisotype from Port Denison, Queensland.

Locs.—Specimens from the following Queensland localities are in the Australian Museum: Lady Musgrave I. (Melbourne Ward); North-West I. (Whitley); Masthead I. (McCulloch); Hayman I. and Holbourne I. (Rainford).

The specimen figured here, Australian Museum regd. no. IA.375, was collected by Mr. E. H. Rainford at Holbourne Island, off Port Denison, Queensland.

Two other species of Brotulid fishes have been recorded from Queensland by Günther,[29] *Brotula ensiformis* Günther from "? Bowen" and *Dinematichthys iluocœtoides* Bleeker from Torres Strait; these records have been generally overlooked.

Lepadichthys frenatus (*Waite*).

One from Hoskyn Island.

Canthigaster valentini (*Bleeker*).

Tetraodon valentini Bleeker, Nat. Tijdschr. Ned. Ind. iv, 1853, p. 130. Amboina.

Canthigaster valentini McCulloch, Mem. Qld. Mus. vii, 1922, p. 244.

One specimen from Lady Musgrave Island. This species has only hitherto been known in Queensland waters from Murray Island.

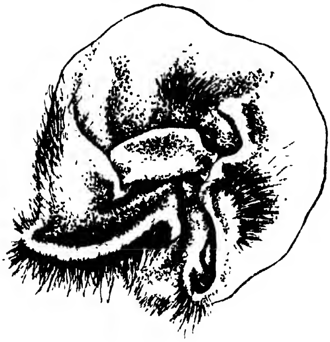
[23] Bleeker.—Nat. Tijdschr. Ned. Ind., viii, 1855, p. 319.
[24] Ogilby.—Proc. Linn. Soc. N. S. Wales, xxiii, 1899, p. 744 (*Diancistrus*).
[25] Hutton.—Trans. N.Z. Inst., viii, 1876, p. 217.
[26] Waite.—Rec. Austr. Mus., v, 1904, p. 185, pl. xxiv, fig. 5.
[27] Hector.—Trans. N.Z. Inst., ix, 1877, p. 466, pl. ix, fig. 77a.
[28] Alcock.—Ann. Mag. Nat. Hist. (6) vi, 1890, p. 432.
[29] Günther.—Fische der Südsee, viii, 1909, pp. 333 and 336.

EXPLANATION OF PLATE XXXIX.

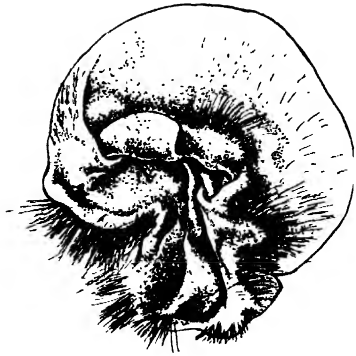
Fig. 1*a-h*. *Planigale ingrami brunneus, subsp. nov.* Holotype ♀.

Fig. 2*a-g*. *Planigale tenuirostris sp. nov.* Holotype ♀.

a. Skull, from above.
b. Skull, from below.
c. Skull, from side.
d. Ear.
e. Rhinarium, front view.
f. Rhinarium, side view.
g. Right pes.
h. Pouch and mammary area.



1*d*



2*d*

1*h*

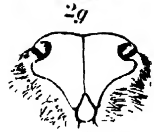
1*f*

2*f*

1*g*

2*g*

1*e*



2*e*

Joyce K. Allen, del.
G. C. Clutton, photo.

STUDIES IN AUSTRALIAN ATHECATE HYDROIDS.

No. 1. Two New Species of the Genus *Myriothela.*

By

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(Plates xxxii-xxxiv and Figure 1.)

Introduction.

Athecate Hydroids are very poorly represented among the marine Hydroid Zoophytes of Eastern Australia. In the following pages two new species of this interesting but little known group, belonging to the Genus *Myriothela,* are described and figured from the coastal waters of New South Wales. In their morphology and histology they present many striking points of difference from other Australian Athecata, and represent a genus not previously recorded from these latitudes of the Southern Hemisphere. My specimens were obtained from a mass of rapidly-drying seaweeds that had been thrown up on the sandy beach of Maroubra Bay, near Sydney, New South Wales. The large solitary hydranths of very remarkable appearance first attracted my attention, but an exhaustive search failed to reveal the presence of further specimens beyond those I had already secured. The hydranths were attached to the lobes of the thallus of a large seaweed and, on closer examination, proved to be representatives of the curious genus *Myriothela.* Unfortunately the specimens already showed signs of maceration, but after fixation in 70% alcohol, are sufficiently well preserved to permit of a detailed description of the external characters and some of the more salient features of the histology. Subsequently, the late Professor Launcelot Harrison discovered a second species of *Myriothela* on the undersides of rocks below low-water mark at Bulli, forty miles south of Sydney. These specimens, fixed in sublimate-acetic and transferred to 70% alcohol, are in an excellent state of preservation for histological purposes. Both species have been studied by means of this fixed material. Serial sections of the hydranths with their attached blastostyles and gonophores were cut in a transverse direction, and afterwards stained with Ehrlich's hæmatoxylin followed by eosin. The sections were cut in thicknesses varying from 6 to 8 μ.

The genus *Myriothela* is represented in the Northern Hemisphere by six species, *M. cocksi, M. phrygia, M. gigantea, M. minuta,*

M. mitra and *M. verrucosa*. In his "Fauna Groendlandia," Otto Fabricius (1780) gave a very brief and inadequate description, under the name of *Lucernaria phrygia*, of the first northern species of *Myriothela* which, however, he duly recognised as a member of the Cœlenterata. De Blainville (1834) created a new genus, *Candelabrum*, for Fabricius' species, but failing to recognise its affinities classed it with the Vermes. In 1849 M. Sars[1] established the genus *Myriothela*, with *M. arctica* for its type, but this species has been shown to be identical with *M. phrygia* (Fabricius). Vigurs, in 1849, gave the name of *Arum Cocksii* to a species which several writers, following Hincks and Allman, considered identical with *M. phrygia* (Fabricius) and *M. arctica*, Sars. Both G. O. Sars (1873) and Bonnevie (1899) have shown that *M. cocksi* (Vigurs) must be regarded as a distinct species. The distinguishing characters which Bonnevie relied upon for the separation of these northern species have been accepted by Benoit (1925), whose work on the gametogenesis of *Myriothela* has been confined entirely to *M. cocksi*. Benoit's summary of the specific characters is as follows: "Chez *M. phrygia*, il y a absence de *claspers* pour maintenir les œufs libérés et l'animal est attaché au sol par des filaments tentaculiformes qui naissent à la base de l'hydranthe. Chez *M. Cocksi Vigurs* il y a des *claspers* et l'animal est fixé aux rochers, non seulement par quelques filaments, mais surtout par des expansions lamelliformes du périderme de *l'hydrorhize*." Bonnevie[2] has also described four new species from the Northern Hemisphere.

The first representative of the genus *Myriothela* to be recorded from the Southern Hemisphere was collected by the Swedish South Pole Expedition off Cumberland Bay, South Georgia, at a depth of 252 to 310 metres. This bizarre form was described by Jäderholm (1904) as a new species under the name of *Myriothela austro-georgiæ*. Later, specimens of *M. austro-georgiæ* were taken by the French Antarctic Expedition from Flanders Bay and Booth-Wandel Island, and by the German South Pole Expedition at Kerguelen Island. The Scottish National Antarctic Expedition also dredged several examples of this remarkable Hydroid in Scotia Bay, South Orkneys, while one specimen was found "on the surface of the water, in a hole which had been cut in the ice."

The discovery of two new species of *Myriothela* in the Southern Hemisphere is extremely interesting since the range of the genus must now be extended from the Antarctic circumpolar seas to include the more temperate waters of the coast of New South Wales. Moreover, by the addition of these new species to the list of gymnoblastic forms which have been definitely recorded from this region, the hitherto very limited number of Athecata has been increased from eleven to thirteen species.

[1] Sars, M.—Zoolog. Reise in Lofoten og Finmarken, 14, 1849.
[2] Bonnevie.—Zeitschr. für Wiss. Zool., lxiii, 1898, pp. 465-495.

DESCRIPTIONS OF THE NEW SPECIES.

Family MYRIOTHELIDÆ.

Genus MYRIOTHELA, *Sars*.

MYRIOTHELA AUSTRALIS, *sp. nov.*

(Pl. xxxii, Pl. xxxiii, fig. 3; Pl. xxxiv, figs. 1-4.)

General description.—The individuals are solitary, growing quite independently of each other upon the surface of a seaweed. In the living condition, or at least before fixation, the general colour of the hydroid is a pale flesh-pink, but in the preserved state it is a pale straw colour.

The hydranth consists of an isolated, attached polyp, carrying near its proximal end the blastostyles, which give origin and support to the gonophores. The hydranth is perfectly naked and is highly contractile. There is no hydrocaulus. The proximal end of the hydranth is truncated and is attached to the substratum by a number of tentacle-like filaments which constitute the hydrorhiza. At the truncated end of each of these short rooting processes is a small, circular, chitinoid disc of a dark brown colour. There is no investment of chitinous perisarc around the proximal end of the hydranth as in *M. cocksi* and *M. harrisoni*.

The hydranth is elongated, cylindrical in form, and gradually tapers towards the apex. The mouth is a small aperture occupying the summit of a short conical hypostome, behind which the tentacles commence and thence extend over the rest of the body down to the blastostyle-bearing zone. The tentacles are capitate with stout cylindrical stems, each terminated by a large spherical capitulum which is well defined and distinct from the stem. These tentacles are very numerous, up to fifteen hundred may be counted on a single hydranth. They are set very close to one another and densely cover the hydranth as far as the blastostyle region where they decrease very much in size, but do not encroach upon this portion of the hydranth as they do in the case of *M. austro-georgiæ*, in which they are found between the blastostyles. The tentacle zone of the hydranth is exceedingly long, occupying about five-sixths of the entire length of the extended polyp.

The blastostyle-bearing portion of the hydranth, which is marked by a series of well-defined longitudinal furrows with finer transverse striations, is slightly narrower than the tentacle-zone immediately above it. The blastostyles are grouped at the base of the hydranth just above its point of attachment to the substratum. This zone occupies about one-sixth of the entire length of the extended hydranth. The blastostyles occur very close together in great abundance and completely obscure the proximal end of the hydranth. They surround the body on all sides, without any very definite

arrangement. The blastostyles, which are unbranched, are elongated, cylindrical, clavate structures. The distal extremity of the blastostyle is swollen into a club-shaped head bearing a cluster of tentacles, which differ from those of the hydranth in their larger size and in the form of the capitulum, which is trumpet-shaped and borne upon a long, slender, cylindrical stem.

On the proximal side of this cluster of tentacles arise the gonophores, which are continued to within a short distance of the attached end. The mature gonophores are spherical in form, supported on narrow cylindrical peduncles, which spring without any definite arrangement from the sides of the blastostyles. The immature gonophores are borne on the proximal part of the blastostyle with the mature ones towards the distal extremity.

The male and female gonophores have an apical opening representing the velar aperture, and are carried on separate individuals. In the female, the blastostyle bears terminally some eight to ten capitate tentacles, and there are usually three or four mature gonophores near the distal extremity and some six to eight immature ones on the proximal side of these. In the male, the swollen head of the blastostyle bears six to nine capitate tentacles. The gonophores are more numerous than in the female, up to fifteen occurring on a blastostyle, but they are slightly smaller than those of the female. In some of the male gonophores the distal pole is encircled by a ring of dark brown pigment granules.

The remarkable structures to which Allman[3] gave the name of "claspers" in his description of *M. cocksi* do not occur in this Australian species.

Locality.—The specimens were found growing on the lobes of the thallus of a seaweed thrown up on the sandy beach of Maroubra Bay, near Sydney, New South Wales. (Coll. E. A. Briggs). *M. australis* may prove eventually to be a shallow-water form.

Type.—The holotype (Reg. No. Y.610), and slides of serial sections have been deposited in the Australian Museum, Sydney.

Forty specimens of this species were obtained ranging from 4 mm. to 30 mm. in length. Further details of the structure of the various portions of the hydroid, together with some notes on the more salient features of the histology may now be given.

HYDRANTH.

Body-wall.—In the body-wall of the hydranth (Pl. xxxiv, fig. 4) the ectoderm is stratified, consisting of an outer part with cells rich in contents and nuclei and an inner lightly-staining hyaline portion.

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[3] Allman—Philosophical Transactions, clxv, 1875, p. 550.

The supporting lamella is very strongly developed and gives off closely placed, thin, either simple or branched, secondary lamellæ which stretch out through the whole of the hyaline portion of the éctoderm. On each side of these secondary lamellæ, in the tentacle-bearing zone, there is attached a layer of well developed longitudinal muscle fibres. These, however, are very poorly developed in the blastostyle-bearing region.

The endoderm of the body-wall consists of large-celled tissue and on its inner side is beset with a series of folds which lie close together and elongated in the direction of the long axis of the body. These folds form thin, remarkably high villi which project into the body-cavity. Each of these endodermal villi, with the exception of the broader basal portion, consists throughout its length of two layers of cells which are separated from each other by a thin secondary lamella given off from the supporting lamella. The villi cease at a point a short distance from the mouth opening. As a general rule they are quite separate from one another, but occasionally two may become closely adpressed near their apices. In the distal region of the tentacle-bearing zone, the villi are characterized by the presence of goblet cells. Each of these is flask-shaped, and consists of an expanded part, which stains lightly, followed by a narrow tail filled with deeply-staining granular cytoplasm. In the middle tentacular region the goblet cells disappear from the villi, which are then characterized by the presence of numerous gland cells. At the apex of each villus is a group of apical cells. In these the cytoplasm is abundant and stains deeply, thus offering a marked contrast to the other cells of the villus, which Hardy[4] refers to as the "vacuolate cells." These possess a large vacuole surrounded by scanty cytoplasm with only a single nucleus. Wedged between the outer margins of these vacuolate cells are other and smaller dark-staining cells which constitute the gland cells. These are very widely distributed throughout the endoderm, but they occur in greatest numbers on the sides of the villi. Occasionally, one or two of these gland cells may occur at the apex of a villus. In the blastostyle-bearing zone the endoderm is almost exclusively composed of vacuolate cells usually loaded with stored nutritive material in the form of nutritive spheres.

The body-wall of the hydranth is richly supplied with large oval nematocysts. Each contains a comparatively thick thread.

Tentacles.—The stalk of the tentacle (Pl. xxxiv, figs. 1 and 3) consists of a single layer of ectoderm and a large-celled endoderm which contains a narrow lumen. The supporting lamella is thin; on its outer side is attached a layer of fine longitudinal muscle fibres. In the capitulum of the tentacle (Pl. xxxiv. fig. 1) the supporting lamella increases greatly in thickness and gives rise to a series

[4] Hardy.—Quart. Journ. Micro. Science (n.s.), xxxii, 1891, p. 519.

of closely-packed fine threads which stretch out to the ectoderm and form the main mass of the apex of the tentacle. These threads or fibres are very distinctly marked off from the ectoderm, and Jäderholm, who has described a similar condition in *M. austro-georgiæ*, suggests that their function is probably to keep the apex of the tentacle in an expanded state even when the rest of the tentacle is contracted. According to Bonnevie's figures[5] the supporting lamella in the species from the Northern Hemisphere increases in thickness very considerably towards the distal end of the tentacle, where it forms a structureless, homogeneous layer somewhat broader than the ectoderm and endoderm taken together.

The endoderm in the apex of the tentacle consists of a single layer of cells which line the upper part of a circular cavity situated in the lower portion of the swollen capitulum. These cells assume a very different character to the endoderm cells of the stalk of the tentacle since they are smaller and very cytoplasmic with deeply-staining contents. The floor of this cavity communicates by a narrow aperture with the lumen in the axial part of the tentacle-stalk.

The capitulum of the tentacle is richly supplied with large oval nematocysts containing a comparatively thick thread. Scattered nematocysts also occur in the ectoderm of the stem and at the bases of the tentacles.

BLASTOSTYLES.

The fully-developed blastostyle has a narrow base of attachment to the proximal end of the hydranth, and a club-shaped extremity on which is borne a cluster of capitate tentacles. The blastostyle has no mouth, but contains an extensive cavity communicating with the general body cavity of the hydranth. In the female, the blastostyle bears terminally some eight to ten capitate tentacles, while in the male the swollen head is provided with six to nine tentacles.

Body-wall.—The body-wall of the blastostyle, like that of the hydranth, consists of a stratified ectoderm abundantly provided with large oval nematocysts (Pl. xxxiv, fig. 2). The supporting lamella is comparatively thin and gives off either simple or branched secondary lamellæ which stretch out through the hyaline portion of the ectoderm. The endoderm is composed almost exclusively of vacuolate cells with a few scattered gland cells in the proximal part of the blastostyle. The endoderm is produced into low conical villi of very characteristic appearance due to the cells being heavily charged with nutritive spheres.

Tentacles.—The stalk of the tentacle (Pl. xxxiv, fig. 2) consists of a single layer of ectoderm and a large-celled endoderm which

[5] Bonnevie.—Hydroida. Den Norske Nordhavs-Expedition, 1876-1878, xxvi, Zoologi, 1899.

contains a very narrow lumen. The supporting lamella is thin. In the capitulum, which is trumpet-shaped, the supporting lamella increases in thickness but still remains comparatively thin. From it arises a series of fine threads or fibres which stretch out to the ectoderm. The endoderm in the apex of the tentacle consists of a single layer of cells which line the upper part of a circular cavity situated in the lower portion of the trumpet-shaped capitulum. In the case of a tentacle from a blastostyle bearing female gonophores, these endoderm cells form an extremely tenuous layer and thus offer a very marked contrast to the endoderm cells occupying a similar position in the capitulum of a tentacle from the hydranth. A tentacle from a blastostyle bearing male gonophores has the upper part of the cavity lined by very cytoplasmic cells with deeply-staining contents. In both types of tentacle the floor of the cavity communicates by a narrow aperture with the lumen in the axial part of the tentacle-stalk. The large-celled endoderm of the stalk is completely cut off from the vacuolate cells (endoderm cells) of the blastostyle by a partition of supporting lamella.

The capitulum of the tentacle is richly supplied with nematocysts which are of two kinds. There are (1) oval to narrow, spindle-shaped nematocysts, and (2) shorter and broader nematocysts with comparatively thick threads. These two types are similar to those which Jäderholm[6] found in the tentacles of the hydranth of *M. austro-georgiæ*. Scattered nematocysts also occur in the ectoderm of the stalk and at the bases of the tentacles.

GONOPHORES.

In a recent publication Benoit[7] has traced in detail the development of the gonophores in *M. cocksi*. This species bears both male and female gonophores on the one individual and even on the same blastostyle. Benoit's material from Roscoff and L'Île Ti-sao-son clearly shows this peculiar arrangement of the gonophores to which he refers as follows: "Ordinairement, chez les *Hydraires*, un blastostyle porte des gonophores du même sexe, mâle ou femelle. La *Myriothèle* présente ce caractère exceptionel d'avoir des gonophores des deux sexes sur le même blastostyle, les gonophores mâles groupés ordinairement à l'extrémité du blastostyle, les gonophores femelles beaucoup plus nombreux, à la base."

In the case of *M. australis* all the gonophores on a blastostyle are of the same sex, and throughout any one individual the sex of the gonophores is uniform. The mature gonophores are spherical in form, supported on narrow cylindrical peduncles which spring without any definite arrangement from the sides of the blastostyles. The immature gonophores are borne on the proximal part of the blastostyle with the mature ones towards the distal extremity. In

[6] Jäderholm.—Wiss. Ergebn. d. schwedischen Südpolar-expedition, 1901-1903, v, 8, 1905.
[7] Benoit.—Archiv. de Zool Exper. et Gen., lxiv, 1925, pp. 85-326.

the female there are usually three or four mature gonophores near the distal end and some six to eight immature ones on the proximal side of these. In the male the gonophores are more numerous though slightly smaller than those in the female, up to fifteen occurring on a single blastostyle. In some of these male gonophores the distal pole is encircled by a ring of dark brown pigment granules.

Both the male and the female gonophores have an apical opening representing the velar aperture. This feature appears to be unique among the species of *Myriothela*, except *M. harrisoni* where a similar condition exists in both sexes. The remarkable structures to which Allman gave the name of "claspers" in his description of *M. cocksi* do not occur in either of the Australian species.

HYDRORHIZA.

The tentacle-like filaments by means of which the truncated base of the hydranth is attached to the lobes of the thallus of the seaweed are covered by a loose mass of débris-laden mucus which spreads out upon the substratum. At the apex of each of these short rooting processes is a small, circular, chitinoid disc of dark brown colour. The wall of the filament consists of a single layer of ectoderm, the cells of which reach their greatest height at the apex where, in all probability, they form gland cells. The supporting lamella is thin, and is devoid of the threads so characteristic of that layer in the body-wall and tentacles of the hydranth. The endoderm cells surround a narrow lumen running through the axis of the rooting process.

Myriothela harrisoni, *sp. nov.*

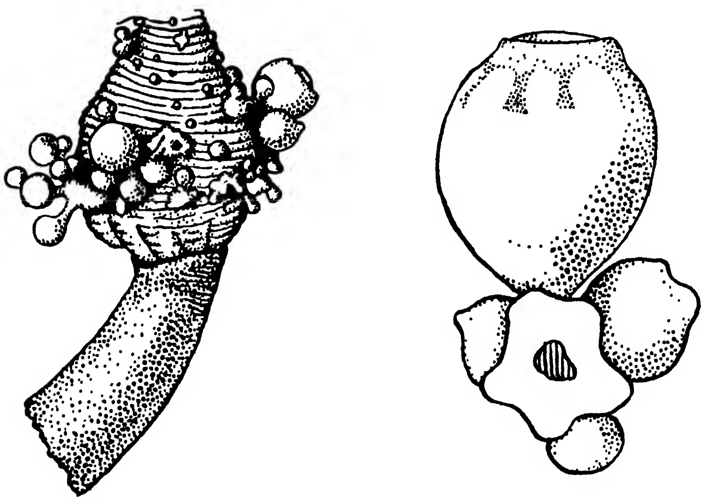
(Pl. xxxiii, figs. 1-2; Pl. xxxiv, fig. 5; and Fig. 1.)

General description.—The individuals are solitary, growing quite independently of each other, hanging freely into the water on the under surface of rocks below the level of low spring tides. In the living state the general colour of the hydroid is pinkish-white, changing to brownish-white on preservation.

The hydranth consists of an isolated attached polyp, divisible into three distinct regions—(1) a slender cylindrical distal portion bearing the tentacles, (2) a swollen, conical middle region bearing the blastostyles, and (3) a proximal hydrorhiza invested by a clear chestnut brown perisarc. There is no hydrocaulus.

The distal portion of the hydranth has the shape of a slender cylinder of even diameter, twelve times as long as broad, tapering slightly towards its junction with the blastostyle-bearing region. It bears upwards of six hundred capitate tentacles, densely crowded and imbricating distally, but becoming sparser proximally, the proximal millimetre carrying only about a dozen small tentacles.

The head of the tentacle is spheroidal, the long axis continuous with that of the peduncle. The peduncle is, in the contracted condition after fixation, one and a half to twice times the length of the capitulum. The transverse diameter of the former is about half that of the latter. A few of the tentacles have confluent patches of pinkish-purple spots upon the distal portion of the capitulum. The base of the tentacle-bearing region, which is comparatively free from tentacles, is transversely wrinkled, with hardly discernible longitudinal striæ, the lines produced by muscular contraction being thus just the opposite of those described below for the blastostyle region. In the contracted condition the hypostome and mouth are not visible.



A. B.

Fig. 1.—*Myriothela harrisoni*, sp. nov. A. Blastostyle-bearing region of hydranth. B. Blastostyle bearing gonophores in different stages of development.

The blastostyle-bearing zone is less than one-third as long as the tentacle-bearing region, but more than twice as wide, and is conical in shape. The blastostyles are borne on the middle zone in such numbers as to hide the surface. The base and apex are practically free from blastostyles, and are marked by fairly deep longitudinal furrows, with fine transverse striæ due to muscular contraction. Each blastostyle consists of an irregularly lobed base with a narrow, cylindrical, distal portion continued into a single terminal tentacle generally resembling those on the tentacle-bearing zone of the hydranth, but flatter distally and of larger size. The lobes of the base represent developing gonophores, the mature gonophores being

borne distally. The latter often appear terminal, having grown so large as to push the single tentacle to one side.

The mature gonophores are sub-spherical in shape, somewhat flattened distally, and are sessile or shortly pedunculate. They exhibit no definite arrangement on the blastostyle.

The male and female gonophores, with an apical opening representing the velar aperture (Pl. xxxiv, fig. 5), are borne upon separate individuals. In the male the blastostyle bears two or three ripe gonophores, and three or four in process of development. The only female individual was cut into sections before the diœcious habit was recognized, and entire blastostyles are not available for comparison. The ripe female gonophore has a diameter almost twice that of the male. Otherwise the female blastostyle has the same general appearance. Allman's "claspers" do not occur in this species.

The hydrorhiza is of variable form. Its main mass is in the form of a short cylinder, the axis of which is set transversely towards the main body of the hydranth, which arises towards one end. This cylindrical portion gives off slender rooting processes, expanded and truncated distally, for attachment to the sub-stratum. The whole of the hydrorhiza is covered by a translucent chestnut-brown perisarc, which is without pattern or any markings other than a few irregular superficial wrinklings.

The detailed discussion of the histology of this species has been reserved for the present and will form the subject of a later paper in this series of studies on the Australian Athecate Hydroids.

Locality.—*Myriothela harrisoni* is a shallow-water form, found on the undersides of rocks below low-water mark at Bulli, forty miles south of Sydney, New South Wales (Coll. L. Harrison).

Type.—The holotype (Reg. No. Y.611), and slides of serial sections have been deposited in the Australian Museum, Sydney.

Affinities of the New Species.

These large, solitary, attached hydranths have been referred to Sars' genus *Myriothela* on account of the elongated, cylindrical, distal portion bearing numerous capitate tentacles; the middle region carrying blastostyles which give origin and support to the gonophores; and the production of the proximal end into an adherent hydrorhiza. They are described as new species differing in several well-marked characters from the other representatives of the genus.

The southern forms, *M. austro-georgiæ*, *M. australis* and *M. harrisoni*, agree in being diœcious. *M. australis* is readily distinguished from *M. austro-georgiæ* by its small size, up to 30 mm. in height; the absence of tentacles from the blastostyle-bearing zone;

and the presence of an apical velar aperture in the male and female gonophores. *M. harrisoni* differs from the other southern species in the presence of a translucent perisarc investing the hydrorhiza, and in the form of the blastostyle, which consists of an irregularly lobed base with a narrow, cylindrical, distal portion continued into a single terminal tentacle. This species shows a certain relationship with the northern forms, *M. phrygia* and *M. cocksi*, in which the hydrorhiza is covered by a dense chitinous perisarc, but here the resemblance ends since *M. harrisoni* is diœcious and the gonophores, male and female, bear an apical opening representing a velar aperture.

Key to the Southern Species of the Genus *Myriothela*.

A. Perisarc present, forming an investment over the hydrorhiza .... *M. harrisoni*, sp. nov.

A.A. Perisarc absent, hydrorhiza naked.

 B. Tentacles of hydranth present on blastostyle-bearing zone .... *M. austro-georgiæ*, Jäderholm.

 B.B. Tentacles of hydranth absent from blastostyle-bearing zone .... *M. australis*, sp. nov.

Summary.

1. Two new species of the genus *Myriothela*, *M. australis* and *M. harrisoni*, are described and figured from the coastal waters of New South Wales.
2. The genus *Myriothela* is now represented in the Southern Hemisphere by three very distinct and characteristic species, *M. austro-georgiæ*, Jäderholm, *M. australis*, Briggs, and *M. harrisoni*, Briggs.
3. The specimens of *M. australis* occur on the lobes of the thallus of a seaweed at Maroubra Bay, near Sydney. *M. harrisoni* is a shallow-water form found on the undersides of rocks below low-water mark at Bulli, forty miles south of Sydney.
4. The salient features in the histology of *M. australis* are described and figured, and attention is drawn to the extraordinary development of the supporting lamella in the capitulum of the tentacles from the tentacle-bearing zone of the hydranth.
5. Both the male and female gonophores of *M. australis* and *M. harrisoni* have an apical opening representing the velar aperture. This unique feature is recorded for the first time among the members of the genus *Myriothela*.

CONTRIBUTIONS TO THE CRANIAL OSTEOLOGY OF THE FISHES. No. VI.*

By

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SOME PERCOMORPH SKULLS.

PAGROSOMUS AURATUS *Gill.*

(Figs. 1-3.)

My material comprises several well grown skulls and one from a young fish, together with two specimens in the flesh.

THE SKULL.

In the skull of an "Old Man" Snapper, as the larger fish are called, with its tremendous occipital knob and massive solid frontal bones, the cranial cavity appears disproportionately small. This, however, is not the fact: the cranium and its processes are of normal size, but are overshadowed by the structures mentioned. The general outlines will be gathered from the drawings.

The large occipital knob is developed entirely from the crest of the supraoccipital bone. The lateral boundary of the occipital fossa is indicated, rather than defined, by the inferior buttress of the epiotic process, whilst the forward continuation of the same process indicates the lateral boundary of the same fossa superiorly. The temporal fossa is a broad trough which lies between the lateral boundaries of the occipital fossa and the outer margin of that flange of the pterotic bone which is continued forward from the pterotic process to articulate with the frontal bone. The dilatator fossa is large; it lies below the flange of the pterotic and above the postorbital lamina of the sphenotic, and its apex is lodged between the two laminæ of the hinder end of the frontal bone. The saccular cavities are approximated to the midline, and there are, therefore, no saccular bullæ. The trigemino-facialis chamber lies immediately below the anterior hyomandibular facet at the angle between the anterior and lateral faces of the prootic bone. The sloping hinder margin of the facet is thrown like a thin "flying buttress" across the chamber; that which may be regarded as the

* For Nos. III-VI and index of abbreviations used on the drawings, see "Records," Vol. XV, No. 3, 1926, p. 201.

true outer wall of the chamber is a splint of bone in front of this. The ventral line of the skull is nearly parallel with the basicranial axis, for, though the myodome is much deeper in front than behind, the cava sacculi are placed between the cranial floor and the myodomial roof toward the hinder end of the myodome.

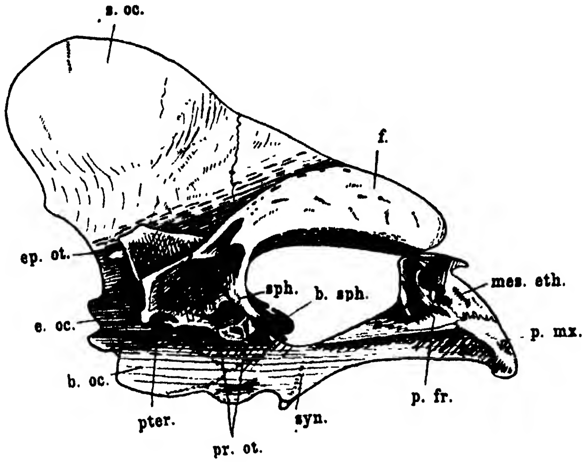

Fig. 1. *Pagrosomus auratus* Gill.

THE CRANIUM.

The *Basioccipital* bone is laterally compressed and rather deep dorso-ventrally. The myodomial recess is placed below the two saccular recesses, which are separated one from the other by a thin lamina of bone which constitutes their common median wall. This vertical lamina sutures with the two horizontal laminæ of the exoccipital bones in front of the azygos sinus. In front of these laminæ its superior margin divides the basicranial fenestra into right and left halves; anteriorly it sutures with the hinder end of the horizontal lamina of the prootic bone. The hinder end of the vertical lamina abuts against the upper half of the condyle. The azygos sinus is quite shallow; for the most part it lies between the horizontal laminæ of the exoccipital bones, but its depth just pits the dorsum of the basioccipital in front of the condyle. The lateral laminæ of the bone are not joined inferiorly, there being no basal lamina developed; the floor of the myodome is constituted by the synpterygoid. It should be noted that in this bone the lateral laminæ form the side walls of the myodomes as well as the side walls of the saccular cavities; this condition, of course, is only possible when these latter are placed close together at a higher level than the myodome. It appears probable that this feature of the basioccipital bone will prove of taxonomic value; it is therefore proposed to designate this type

of basioccipital bone the *hypomyodomial,* in distinction to the *paramyodomial* type, in which the myodome and cava sacculorum lie side by side at, or almost at, the same level.

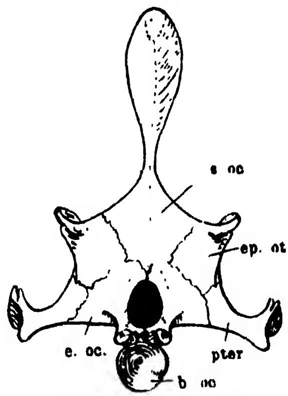

Fig. 2. *Pagrosomus auratus* Gill.

The buttress of the *Exoccipital* bone is but poorly developed and both the spino-occipital and the vago-accessory foramina issue below it. The inferior vertical lamina is small, the superior sutures with its fellow of the other side and with the inferior margin of the occipital crest. The horizontal lamina meets its fellow both behind and in front of the azygos sinus, and sutures with the median vertical lamina of the basioccipital bone. The small otic mass of the bone lodges portion of the posterior semicircular canal, but in a sulcus, not as usual in a complete canal.

The body of the *Supraoccipital* bone appears narrower than it really is, by reason of the large size of the crest. Anteriorly the crest is continued over the hinder end of the fused frontals for a little distance and then meets the median crest of those bones in a vertical suture. The vertical lamina is nearly as thick as it is broad, and carries the inferior and posterior portion of the crest.

The lateral surface of the *Prootic* bone and the myodomial lamina thereof lie almost in the same plane as the myodomial lamina of the basioccipital. The anterior surface of the bone, in the postorbital wall, is a relatively small area in the immediate vicinity of the trigemino-facialis chamber. The horizontal lamina is abruptly differentiated into cranial and saccular components. The former is a narrow triangular area, with the apex of the triangle as usual at the trigemino-facialis fossa; the latter is stepped down behind the former, and slopes from its origin upward towards the cranial floor. The trigemino-facialis and the lower

portion of the arcuate fossa are lodged in the body of the bone to the outer side of the horizontal lamina.

The *Opisthotic* and *Pterotic* bones are intimately fused, and, owing to the wide variations observable in other forms, it were not wise to attempt to decide the possible limits of the two components of the *Opisthopterotic* bone which results from the fusion. The bone presents a body, which shares in the formation of the outer wall of the otocrane, a pterotic process and an obliquely oriented flange which extends forward from the pterotic process, crossing the dorsal surface of the sphenotic, to reach the frontal. The body of the bone is roughly pyramidal, the apex of the pyramid being at the pterotic process. On the cranial aspect there are two conical pits; these communicate at their apex through the short horizontal bony canal. Together with that canal the pits lodge the horizontal semicircular canal. The pterotic process ends in a spur which stands out down and backwards, and bears the posterior hyomandibular facet on the under side at the root of this spur. The free edge of the flange presents the openings of three radiating canals of the latero-sensory system; these radiate from the base of the pterotic process, a short, fourth, canal opens behind the base of the process, and a fifth, opening just where the flange is sutured to the frontal, is so wide that in this situation the flange must be described as bilaminate. The bone presents sutures with the exoccipital, epiotic, sphenotic, prootic, and frontal bones.

The *Epiotic* resembles the body and process of the last bone; there is, however, but a single, and that a larger cavity on the cranial aspect. This cavity lodges part of the posterior semicircular canal and communicates with the posterior bony canal, which runs vertically upwards immediately beneath the external table of the posterior surface of the bone, to open into the cavity near its apex. The epiotic process is very like the pterotic and bears on its upper aspect the facet for the supraclavicula. The bone sutures with the exoccipital, supraoccipital, parietal, sphenotic, and pterotic bones.

The body of the *Sphenotic* is a low hollow cone. The cavity lodges the greater part of the temporal fossa in front and the arcuate fossa behind, the two being separated by a nearly vertical thin lamella of bone. Laterally, *i.e.*, externally, the bone bears a large flange, which constitutes the post-orbital wall lateral to the alisphenoid. This flange is well strengthened below, where, at its root, the bone contributes the upper half of the anterior and larger facet for the hyomandibular bone. Although not a large bone, the sphenotic sutures with the frontal, parietal, epiotic, opisthotic, pterotic, prootic, and alisphenoid bones.

The horizontal lamina of the *Basisphenoid* is a little wider antero-posteriorly than is usual in the Acanthopterygii, so that

quite a small pituitary fenestra is left between it and the horizontal laminæ of the prootic. The vertical lamina also is wider antero-posteriorly than is usual.

The *Parietal* bone is an approximately triangular lamina situated in front of the epiotic and sphenotic, between the supra-occipital to the inner side of the frontal laterally.

The two *Frontal* bones are fused together and swollen into an extraordinary tongue-shaped mass. Though this peculiar heavy deposition of bony tissue is heaviest forward, it is still sufficiently heavy posteriorly to disguise the fact that there is a narrow alisphenoidal lamina developed. Posteriorly the bone is split into anterior and posterior lamellæ, which lodge between the apex of the dilatator fossa. The anterior lamella sutures with the flange of the sphenotic, the posterior and more superficial lamella sutures with the anterior end of the pterotic process, and like that is split in two by a sensory canal.

No *Postfrontal* bones can be detected in either the young or adult skulls.

The inferior processes of the *Prefrontals* suture with the body of the synpterygoid on either side of the vomerine process thereof, and then meet above in a synchondrosis, which also involves the process. In some cases the two prefrontals are in actual contact in the suture, in others there is an appreciable quantity of cartilage between them and the synpterygoid, and this variation is not related to the age of the individual. The wings of the prefrontals are fairly wide and meet the mesethmoid both above and below the olfactory foramina, and make contact with the fused frontals by their dorsal edges, there being no definite superior processes. The bones bear each two facets for the maxillæ, and suture with the mesethmoid immediately in front of the anterior of these.

The relatively small *Alisphenoid* bone sutures with the frontal, prootic, and basisphenoid bones; there is no pterygoid process.

The irregularly shaped *Mesethmoid* bone is fitted in between the two prefrontals, with the anterior end of the synpterygoid and the premaxilla below it. Contact between it and the prefrontals is fairly close, but below there is a fairly extensive gap, which in the fresh state is filled by cartilage.

The *Nasals* are long narrow bones attached by fibrous union to the frontals above and to the inner margin of the anterior suborbital below.

The body of the *Synpterygoid* is triangular in section, and anteriorly the sides are continued upward as a low flange on each side, so that a trough is here formed on each side of the vomerine process. The alæ are small, and there are no alisphenoid processes.

Immediately below the alæ a triangular spur projects beyond the ventral line and just behind this the branchial tubercle is well developed. The posterior end of the bone is bifid, and between the two splints thus formed there is a considerable opening into the myodome.

There is, of course, no *Orbitosphenoid* bone present in this skull.

THE CRANIAL WALLS, RECESSES, AND FORAMINA.

The occipital segment of the cranial floor is formed by the horizontal laminæ of the exoccipital bones, which completely exclude the basioccipital from the foramen magnum. The azygos sinus is triangular: the apex of this triangle is anterior and the sinus grows shallower as the tip of the apex is reached. The vago-accessory foramen is situated at the side of the anterior edge of this segment of the floor. The basicranial fontanelle extends the full width of the floor in the mesotic region, leaving the saccular cavities widely open in the prepared skull. The prepituitary floor is tilted up from the preotic, than which it is a little narrower. The pituitary fenestra is smaller than usual. The lateral obturator membrane is attached in front to the edge of the lamina of bone which separates the temporal from the arcuate fossa. Above this it swings upward and back along the anterior and dorsal margins of the pterotic bone; it then swings mediad and downward along the dorsal and posterior margins of the same bone to the antero-dorsal corner of the vertical lamina of the exoccipital. By the anterior edge of this it is carried down to the floor level and crosses to the other side along the anterior edge of the horizontal lamina of the same bone. At the inferior end of the lamina with which we started the attachment of the membrane passes on to a ridge on the horizontal lamina of the prootic bone; by this it is carried slightly back and to the mid-line, where it meets and passes to a similar ridge on the other prootic. This description of the attachment of the membrane describes also the boundaries of the lateral and basicranial fenestræ, which are continuous one with another and across the mid-line, so that it is not possible to describe a basicranial obturator membrane apart from the other. The two large saccular cavities are separated by a thin partition of bone, and above this by a narrow band of fibrous membrane, which gains attachment to the basicranial obturator membrane along the mid-line.

The trigemino-facialis fossa has one small and three large foramina on its floor: apparently all transmit branches of the fifth and seventh nerves.

The internal carotid arteries perforate the horizontal lamina of the prootic at the boundary between the cranial and saccular

faces, appearing on the cranial aspect at the inner end of that ridge described as forming the posterior boundary of the trigemino-fascial fossa.

The *Myodome* is relatively a large cavity; it is triangular in outline in front and tapers from before back. The floor is formed entirely by the synpterygoid, and there is a deficiency in the floor posteriorly.

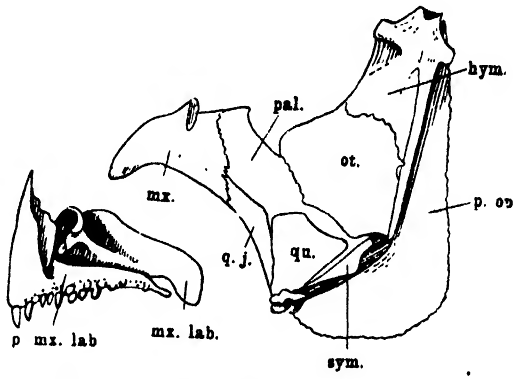

Fig. 3. Right maxillo-palatine arch and labial bones from within.

PALATE AND UPPER JAW.

The shape of these bones is adequately shown in the drawings; it remains only to state that the maxilla is monobisartete, and the hyomandibula binarticulate.

Sparus.

One specimen of *Sparus australis* Günther has been examined; from this it may be stated that the only differences between this skull and the last are unimportant. There is quite an extensive hiatus, in the fresh specimen filled in by cartilage, between the pterotic, epiotic, and prootic on the dorsum of the skull. A similar, but smaller, hiatus is present in the young *Pagrosomus auratus*. There is no massive supraoccipital crest or fused frontals as in the last skull.

Pomadasys.

As I have but a single specimen of this skull, and as, moreover, this single skull will not disarticulate, a detailed description of it is not possible.

Generally the resemblance is to the skull of *Pagrosomus auratus*, but with marked differences. The frontals are fused

together as in that form, but they are channelled and pitted for the lodgment of organs of the lateral line system. The dorsum of the ridge which continues anteriorly and medially the pterotic process is markedly expanded and hollowed out to form a wide open trough for the reception of the hinder end of the series of organs lodged in the frontal bones. The pterotic lateral line trough is bridged by three or four spicules of bone which, equally spaced, have the appearance of a short ladder laid on its side along the trough. The auditory bulla is very large, apparently constituted as in *Pagrosomus*; it differs therefrom in being markedly inflated, so that the two together produce a cordiform prominence on the base of the skull. The basisphenoid is a much smaller bone in this form than in *Pagrosomus*, the three arms being little more than spicules of bone.

The development of outstanding laminæ and spinous processes from the periotic and cranial bones gives rise in many fishes to two more or less definite fossæ. These are particularly well developed in *Platycephalus* and were described in detail in connection with that skull[1]. In *Pomadasys*, *Pagrosomus*, *Sparus*, and *Girella* the occipital fossa can hardly be said to be present, though its situation and extent are clearly indicated by the prominent ridges of the supraoccipital and the epiotic. The temporal fossa is well developed in all these forms, lacking only the roof, which, however, is present in only a small proportion of those skulls in which the fossa is developed. The floor of the temporal fossa is the meeting place of some or all of the following bones: epiotic, exoccipital, opisthotic, pterotic, prootic, sphenotic, and parietal, and it forms the outer wall of the otocrane. No true suture is formed between epiotic, pterotic, prootic, and parietal, and the cartilage of the synchondrosis it at times so extensive as to result in a marked hiatus in the outer otocranial wall. Amongst the skulls which I have examined this "lateral cranial foramen" reaches its maximum in *Pomadasys hasta*. The term "lateral cranial foramen" is taken from Ridewood,[2] who describes very similar conditions in some of the Mormyridæ. In these forms the deficiency between the epiotic and pterotic (squamosal of Ridewood) is such that the exoccipital bounds the foramen posteriorly; in my forms the epiotic and pterotic always meet to exclude the exoccipital from the boundary of the foramen. Ridewood states that the foramen opens into the cavum cranii; there is little doubt that it opens, as in my forms, into the otocranial cavity.

As a whole the skull of *Pomadasys* is more dorso-ventrally compressed than is that of *Pagrosomus*.

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1 Kesteven.—Rec. Austr. Mus., xv, 3, 1926, p. 218.
2 Ridewood.—Linn. Soc. Lond., Journ. Zool., xxix, 1904, pp. 188-215.

GIRELLA.

Girella tricuspidata Quoy and Gaimard is one of the commonest food fishes of the Myall Lakes in my immediate neighbourhood so that I have had an unlimited supply of material for the study of this skull. Having described *Pagrosomus* in detail the description of *Girella* is not called for, such is the resemblance between the two forms. The skull of *Girella* is devoid of the massive supra-occipital crest, and the massive fused frontals, and it is more dorso-ventrally compressed, approaching more nearly the shape of *Pomadasys*. In *Sparus*, *Pagrosomus*, and *Pomadasys* the frontal bones override the mesethmoid. In *Girella* the mesethmoid is lodged between the fore ends of the frontals and continues forward of them in the same plane a little distance before dipping ventrally to suture with the premaxilla.

EPINEPHELUS.

(Figs. 4-7.)

Under the name of *Promicrops itaiara* I described the upper jaw and palate of *Epinephelus lanceolatus* Bloch. and illustrated the lateral aspect of the cranium.[3] The correction in the name is adopted from McCulloch.[4]

It is not proposed to repeat the description of the palate and upper jaw; the outline drawing provided is sufficient for all present purposes. The detailed descriptions of the cranium and component bones which follows is founded on the same material that was used in 1922; it comprises a very fine complete skull prepared from a fish weighing 62 pounds, which I had the pleasure of catching on a hand line myself, and the completely disarticulated skull of a slightly smaller specimen captured at the same time by another member of our party off the Great Barrier Reef near Gladstone in Queensland.

The general shape of the cranium is well shown in the drawings.

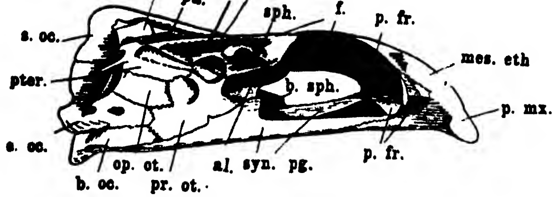

Fig. 4. *Epinephelus lanceolatus* Bloch.

[3] Kesteven.—Journ. Anat., lvi, 1922, p. 308, figs. 1-4.
[4] McCulloch.—The Australian Zoologist, ii, 2, 1921, p. 55 [*or* Check List of the Fishes . . . of New South Wales, 1922, p. 45].

CRANIUM.

The *Supraoccipital* appears on the dorsum of the skull as a relatively long narrow bone, coming abruptly to a point in front, where it sutures with the frontals, tapering slowly to a point behind, where it projects well beyond the hinder limit of the other bones on the dorsum of the skull, to form the supraoccipital crest.

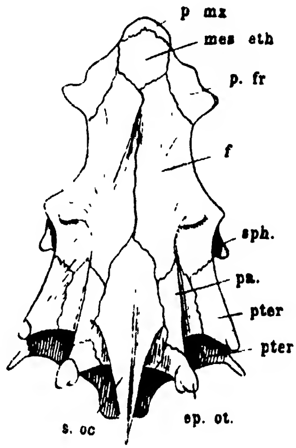

Fig. 5. *Epinephelus lanceolatus* Bloch.

The crest is fairly deep and its free edge drops nearly vertically to meet both exoccoipitals above the foramen magnum; these latter bones meet one another in an extensive suture, and along their dorsal edges provide a sulcus for the ventral edge of the occipital crest. On either side of the crest near its dorsal edge there is a narrow horizontal flange, which, widening as it passes forward, gains attachment to the dorsum of the body of the bone towards its hinder border; it is the presence of these two flanges that enables one to describe the bone as tapering slowly behind. A sharp ridge runs down the centre of the dorsum of the bone; low anteriorly it becomes more elevated behind and becomes the crest beyond the body of the bone.

The under surface of the body of the bone occupies the centre of the cranial ceiling posteriorly. A little in front of the centre of its length a small pocket with an arcuate margin is found to constitute the hinder boundary of a shallow depressed area in the middle of the width of the bone; this area is continued forward on to the frontals, and corresponds with the area described as covered with cartilage on the ceiling of the cranial cavity of *Pterygotrigla*.[5] In that case, however, the cartilage covered area

[5] Kesteven.—*Loc. cit.*, p. 220.

was confined to the frontals, in this the cartilage extends back to fill the pocket described above on the under surface of the supraoccipital. The supraoccipital bone sutures with the exoccipital, the epiotic, parietal, and frontal bones.

The *Epiotic* bone is wedged in between the supraoccipital, parietal, pterotic, and exoccipital bones. The body of the bone bears some resemblance to a low four-sided pyramid, hollowed on the inner side. The articular facet for the upper arm of the supratemporal is borne on a short stout ridge, which crosses the dorsum of the bone from before backward and slightly outward, and on the upper edge of a strong flange of bone which stands out from the postero-lateral angle of the bone; the postero-dorsal angle of the bone is also developed into a strong ridge for the further support of the inner side of the facet. The cavity is apparently entirely otocranial, and the bony posterior semicircular canal is to be found in the posterior angle thereof separated from the general cavity of the bone by a thin bony partition; superiorly this canal opens into the general cavity, inferiorly it is continued in a somewhat similar canal in the exoccipital bone. In a dorsal view of the skull little of this bone except the epiotic process and its two solid struts is to be seen; in a posterior view of the skull the body of the bone is visible between the vertical flange of the process and the supraoccipital bone, whilst in a lateral view, with the pterotic bone removed, a nearly correct idea of the size of the body can be obtained.

The *Exoccipital* bone is of quite irregular shape. The exoccipital condyle is of the usual form and is surmounted anteriorly by the vertical lamina. This lamina forms the side wall of the cranial cavity in its posterior portion and meets its fellow of the other side above the foramen magnum and along the posterior segment of the cranial ceiling. The laminæ do not meet one another in linear suture dorsally as in the other forms described, but fairly extensive areas on the median surfaces of the two bones are in contact; these areas are composed of open cancellous bone, and are united by cartilage. In front of the condyle and in front of and below the lamina, an irregular otic mass of the exoccipital bone contributes to the formation of neurocrane and otocrane. Immediately to the inner side of the condyle a stout narrow horizontal lamina projects medially to meet its fellow of the other side and forms the postotic floor of the cranial cavity; proceeding forward the floor widens slightly as the side wall recedes from the centre line till the spino-occipital foramen is reached. From this point the inferior margin of the vertical lamina rises dorsally and arches towards the centre. Between the lower margin of the vertical lamina and the lateral edge of the floor there is a triangular area which looks upward and inward. The apex of the triangle is at the spino-occipital foramen, at the antero-ventral

angle is the vago-glossopharyngeal foramen. The triangular area itself is composed of a thin lamina of bone which separates the cranial from the otic cavity, and forms the outer wall of the bony compartment for the posterior semicircular canal, which latter communicates when in position with the segment of that compartment lodged in the epiotic bone. Lateral to this compartment the remainder of the otic mass of the bone, of irregular shape, contributes to the formation of the outer wall of the otocrane and the compartment for the horizontal semicircular canal. To the inner side of the triangular area the horizontal lamina forms the floor of the cranium and also the roof of the cavum sacculi. There is a pit, the azygos sinus, in the floor of the cranial cavity between the two spino-occipital foramina; in this situation the inter-exoccipital suture is interrupted by a cordate gap. This gap is the opening of the sinus, which extends down through the exoccipital bones into the basioccipital; the long axis is directed down and back and ends in a blind point immediately in front of the depth of the basioccipital condyle. Very definitely there is no communication with the hollow of the condyle. I have not the material in the flesh to investigate the contents of this peculiar little pit, but suggest that it may be that it is in some way related to the fore end of the notochord. Below the level of the cranial floor the inferior lamina forms the upper outer wall of the hinder half of the cavum sacculi. The buttress of the neural facet is short and stout.

The paramyodomial *Basioccipital* bone presents the typical condylar facet posteriorly, and has in front thereof a triangular body, which is excavated dorsally on either side of the mid-line for the lodgment of the lower portions of the two cava sacculi, and ventrally along the mid-line to form the hinder end of the myodome. The two saccular cavities are widely open dorsally, whilst the myodomial cavity is closed on all sides and ends in a blind point about the centre of the length of the bone. A thin lamina of bone surmounts the length of the upper surface of the myodomial ridge and articulates with the two exoccipital bones, separating the two saccular cavities. Posteriorly this lamina develops horizontal flanges which form the floor of the azygos sinus.

The *Parietal* is a nearly triangular bone lying between the supraoccipital to the inner side, the pterotic and sphenotic to the outer side, the epiotic behind it, and the frontal in front. For the most part it is flat, but there is a narrow down-turned flange suturing with the epiotic. A forward continuation of the superior ridge of the epiotic process runs along the length of the dorsum of the parietal bone as a low ridge and is continued along the frontal in front of it.

The *Pterotic* bone may be described as composed of a body, pterotic process, and anterior process. The body is of a flattened

pyramidal shape; its cavity is apparently for the lodgment of the horizontal semicircular canal and its ampulla. The anterior process is a flange of bone, which is thrown across the sphenotic to suture with the frontal as in *Pagrosomus;* posteriorly this anterior process becomes the pterotic process, and is continued medially and downward behind the body of the bone as a broad flange terminating at the postero-median and ventral corner of the body. Immediately behind and below the pterotic articular facet there is a spur, developed from the upper end of the flange, which stands out and back under the dorso-lateral arm of the supratemporal bone.

The *Opisthotic* bone is a squame which overlies the suture between the pterotic and exoccipital on the side of the skull and portions of the sutures of the pterotic and exoccipital with the prootic. Immediately beneath the pterotic process the opisthotic bears an articular facet for the attachment of the ventral arm of the supratemporal bone.

The *Prootic* bone is quite irregular and its shape must be gathered from the drawings. On the external surface a fairly broad lamina forms an outer wall to the trigemino-facial chamber, leaving anterior and posterior openings. The inner side of the bone is even more irregular than the exterior and more difficult of description. The horizontal lamina which forms the anterior moiety of the cranial floor and myodome roof is readily recognisable and may be used as the starting point of our description. Below, this myodomial wing forms the outer wall and floor of the anterior part of the myodome; this does not reach its fellow of the opposite side, but sutures with a ridge on the dorsal surface of the synpterygoid. To the outer side of the cranial floor there are several recesses in the body of the bone; of these the largest is the anterior portion of the cavum sacculi, which extends below and behind the horizontal lamina, there being a gap here between the exoccipital and prootic components of the cranial floor, except in the mid-line where the two infero-median walls of the cava sacculi meet at floor level. Lateral to the preotic cranial floor there is a recess with honeycombed walls, the trigemino-facial fossa; its wall is perforated by three foramina for the exit of the trigeminal and facial nerve trunks, and it probably lodges the ganglia of those nerves. Above the level of this last recess and also behind it there are four otocranial recesses. The prootic bone sutures with the synpterygoid, basisphenoid, alisphenoid, sphenethmoid, pterotic, opisthotic, exoccipital, and basioccipital bones. Immediately to the inner side of the trigemino-facial fossa is a foramen, probably the oculomotor foramen.

The *Sphenotic* appears to have the post-frontal fused with it; it lodges part of the anterior semicircular canal, sutures with the alisphenoid, frontal, pterotic and prootic. Where the bone sutures

with the prootic it forms the upper half of the anterior facet for the articulation of the hyomandibular.

The *Alisphenoid* sutures with sphenotic, prootic, synterygoid, and frontal bones; a flat bone placed diagonally in the wall of the cranium antero-superiorly, it bears a small flange, the pterygoid process, close to its inferior edge, which projects down and out to suture with the prootic and synpterygoid; this suture is interrupted by a foramen, which either gives access to a vein entering, or egress to a nerve leaving, the trigemino-facial chamber in the prootic bone.

The *Basisphenoid* is of the usual form and calls for no further comment.

The *Synpterygoid* bone is broad behind, where it underlies the prootic bones and forms the median portion of the floor of the myodome; in front of the prootic bones there is an alisphenoid process on either side which strongly resembles that of *Platycephalus,* and, like that, serves as the anterior part of the floor of the myodome. In front of the alisphenoid processes the bone narrows rapidly and bears a vomerine dorsal lamina; the vertical limb of the basisphenoid sutures with the hinder end of this lamina, and anteriorly median, backwardly projecting spurs of the prefrontals suture with it. The palatine plate of the premaxilla is applied to the under surface of the anterior one-third of the bone.

The form and situation of the *Frontal* is adequately shown in the drawings.

The *Prefrontal* bone is antero-posteriorly flattened, concave behind and convex in front; from the median border there is given off a backwardly projecting boss, which divides into superior and inferior processes. The upper sutures with the frontal, the lower with the anterior end of the vomerine lamina of the synpterygoid. A deep sinus separates the superior process from a smaller process just above it; the olfactory peduncle passes forward to the nasal chamber through the sinuation enclosed in the cartilage which fills the spaces between the bones in this situation. Immediately to the outer side of the sinus the bone is perforated for the passage of a terminal branch of the superficial ophthalmic nerve. To the outer side of this foramen, in front, there is the superior condyle for the articulation of the maxilla; the inferior condyle is situated below, behind, and to the inner side of the superior. The infero-lateral corner of the bone bears a facet for the attachment of the first subocular bone. The prefrontal bone sutures with the frontal, mesethmoid, premaxilla, and synpterygoid, and articulates by amphiarthroses with the maxilla and first subocular bone. The two bones meet one another in a short median suture above the fore end of the synpterygoid; above this interprefrontal suture there is a considerable space between these two bones on either

side, the frontals above, the mesethmoid in front, and the premaxilla below, filled with hyaline cartilage in the fresh state; the cavity in question extends forward into the premaxilla, as also does the filling of cartilage.

The *Mesethmoid* bone presents a strong ridge down the centre of the sloping anterior face and a level triangular area between the anterior ends of the frontal bones.

The *Premaxilla* presents an anterior sloping surface which continues the mesethmoid plane and central ridge; the latter, however, ceases before the inferior margin of the bone is reached, and below it the surface of the bone is evenly rounded. Inferiorly the bone bears teeth on an arcuate area in front; behind that area the surface of the bone lifts. The palatine process is strongly convex and tapers to a terminal point.

CIRCUMORBITAL BONES.

The form of these is shown in the little sketch of the lateral aspect of the orbit (Fig. 6); the second suborbital carries a large internal lamina supporting the globe of the eye, as in *Girella* and other Sparids.

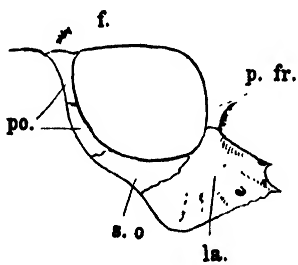

Fig. 6. *Epinephelus lanceolatus* Bloch.

THE CRANIAL BOUNDARIES AND THE OTOCRANE.

(Fig. 7.)

In the region of the exoccipital bones the cranial walls are complete except for the azygos sinus already described. In front of this bone the cranial walls and floor are formed by the membranous inner walls of the otocrane and the roof of the cava sacculorum where they are in contact beneath the brain case (lateral and basicranial obturator membranes).

The outer wall of the otocrane as viewed from within presents seven recesses; of these the most posterior is in the exoccipital bone. Its opening is directly above the vago-glossopharyngeal foramen (ix, x) and is a deep conical pit which extends back almost to the spino-occipital foramen (xi, xii). Immediately within the pit are two apertures of the incomplete bony semicircular canals; that for the posterior semicircular canal (P.c.) is in the roof, and the canal itself can be followed as it curves upward on the surface of the epiotic bone, to open close to the roof. The posterior aperture of the horizontal canal lies just below the lower opening of the other (H.c.). The canal itself is situated entirely

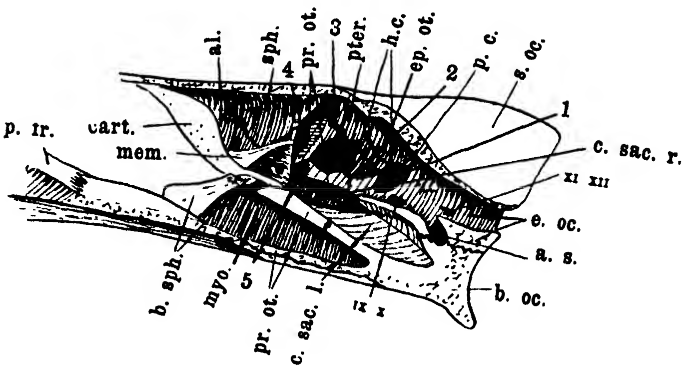

Fig. 7. *Epinephelus lanceolatus* Bloch.

in the pterotic bone; its anterior opening will be found in the upper part of the recess No. 3. The second recess is very similar to the first but smaller, and, like it, extends back in the substance of the exoccipital bone beneath No. 1. It opens on to a shallow fossa (2) crossed by the suture between the exoccipital and prootic bones.

The third recess (3) as depicted in the drawing, lies in the upper part of the prootic, but almost as large a portion of the recess extends up into the pterotic, and is hidden from view. The fourth recess (4) is the arcuate fossa; it lies in the prootic below and the sphenotic above and anteriorly; this is the largest recess of all and as far as my material allows me to judge, it contains nothing but fatty connective tissue. The fifth is a small

recess in the prootic bone below and behind the fourth, really a separated portion of the arcuate fossa; it also, apparently, lodges only fatty tissue. The sixth recess is the cavum sacculi (C. Sac. l., C. Sac. r.). The seventh recess is almost the mirror image of the second, lying in front of the fossa, on to which the second opens, in the prootic bone. Posteriorly the floor, lower half of the lateral, and the whole of the median walls of the saccular recesses are formed by the basioccipital bone, the roof and upper half of the lateral walls by the exoccipital bones. Forward of these bones the recesses are lodged in the periotic bones.

The lateral obturator membrane is attached in front to the vertical anterior margin of the arcuate fossa, from the foot of which its ventral edge passes back to the lower extremity of the posterior margin of the first recess; between these two points of attachment the membrane spreads out horizontally to form the floor of the cranial cavity and roof of the saccular recesses, meeting its fellow of the opposite side in the mid-line, where they combine and give off a vertical partition downward between those two recesses. The attachment of the membrane dorsally appears to be along the outer edge of the epiotic and across the pterotic to the upper end of the anterior margin of the fourth recess.

The trigemino-facial fossa lies in front of the arcuate fossa. The foramina for the fifth and seventh nerves are towards the upper outer corner, and the oculomotor foramen lies to the inner side of these at a lower level.

In the fresh state a strong band of fibrous tissue extends across the cranial cavity from the upper and outer corner of one trigemino-facial fossa to the other, and the optic foramen lies below the middle of this band, between it and the middle of the basisphenoid bone. Immediately behind the body of the basisphenoid there is a small gap in the floor between that bone and the fore ends of the prootic bones; this is the pituitary fontanelle. Above the band of fibrous tissue, the space between the alisphenoids, basisphenoid, and frontal bones is filled by a thick mass of hyaline cartilage, permeated, however, on its lower face by a layer of tough fibres. This lower layer of fibro-cartilage may be described as derived from the fibro-cartilaginous inter-orbital septum, which splits into right and left halves where it meets the hyaline cartilage, each half becoming strongly reinforced by additional fibres.

There is a foramen in exactly the position of that which Allis[6] terms the internal carotid foramen in *Scomber* between the

[6] Allis.—Journ. Morphol., xviii, 1903, p. 91.

synpterygoid and the prootic, and there is also a foramen in the situation of that which he terms the abducent foramen, and I believe that I have located the trochlearis foramen above the transverse band of fibrous tissue between the alisphenoid and the hyaline cartilage, just as he describes and figures it.

Epinephelus merra *Bloch*.

The possession of one small complete skull of this species enables me to state that it resembles in all essential respects the previous species.

Other Serranids which I have been able to examine include *Acanthistius serratus* Cuv. and Val., and *Callanthias allporti* Gthr., and their resemblance to *Epinephelus* is such that that they do not call for separate description.

Oligorus.

(Figs. 8-10.)

My material for the study of the skull of this genus consists of a complete skull and a cranium of *Oligorus macquariensis* Cuv. and Val. Since I have been able to partially disarticulate the cranium, the illustration of the skull is undertaken with confidence; both the specimens are from young fish, but there is no reason to doubt that they present all the features of the adult skull.

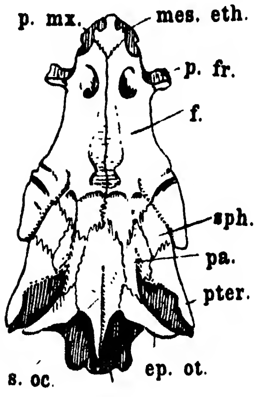

Fig. 8.

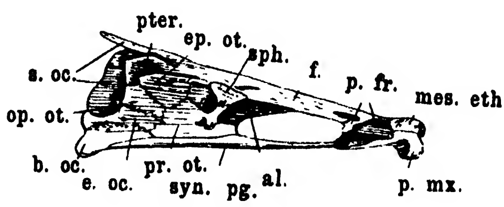

Fig. 9

Oligorus macquariense Cuv. and Val.

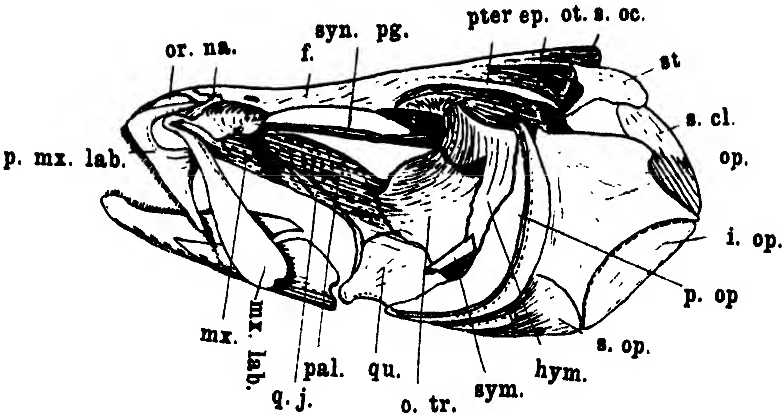

Fig. 10. *Oligorus macquariense* Cuv. and Val.

The resemblance of this skull and of its related arches to *Epinephelus lanceolatus* is in all respects so close that it does not call for separate description.

CHEILODACTYLUS.

(Figs. 11-16.)

My material for the study of this genus is a single complete skull of *C. spectabilis* Hutton. Though I have not risked its destruction by endeavouring to disarticulate it, I have removed the visceral bones as the description progressed, and have divided the cranium with a fine saw in the sagittal plane so as to examine the interior of the cranial cavity.

The skull proper in its contours bears a general resemblance to that of *Sparus*, but it is deeper from above down. Lateral and posterior outlines are shown in the drawings. From above

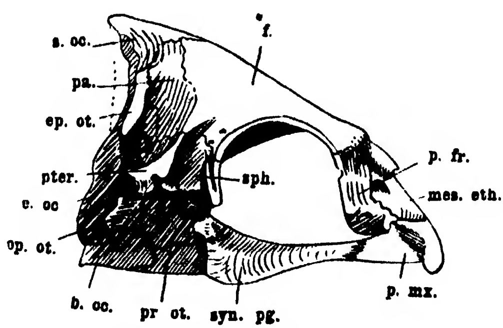

Fig. 11. *Cheilodactylus spectabilis* Hutton.

the cranial outline is quadrilateral with epiotic, pterotic, and sphenotic ridges standing well out. The quadrilateral outline of the cranium is continued forward in the inter-orbital region. In front of the prefrontal bones there is a sudden constriction; the outline tapers to the premaxilla, which is squarely truncated in front.

THE CRANIUM.

The *Supraoccipital* is a roughly pyramidal bone, the laterally flattened apex of which is the occipital crest. The dorsal line of the crest is continuous with that of the skull, so that the crest stands out posteriorly only; it is short and stout. Below the crest a thin lamina is continued down to the ventral limit of the bone. There is reason to believe that a straight line drawn from the extremity of the crest to the lower limit of the bone would coincide with the true posterior limit of this lamina. In my specimen it is imperfect, the dotted line (Fig. 11) indicating its assumed true extent. The body of the bone is more massive than is general, the portion which forms the posterior moiety of the roof being particularly thick, whilst the portions which form the contiguous side walls of the cavity are only a little less substantial. The lamina which forms the upper part of the posterior wall of the cranial cavity is a good deal thinner than the rest of the bone. The supraoccipital articulates with the frontal, parietal, pterotic, and epiotic bones.

The *Epiotic* is an irregular concavo-convex bone the concave face being, of course, internal. The external surface presents both posteriorly and laterally. The posterior laminæ meet in the median sagittal plane, separating the supraoccipital from the exoccipital bones. As seen from without this contact is nearly hidden by a median downward projecting spur of the supraoccipital which overlies most of the contact (in the drawing, Fig. 12, this spur has been omitted so as to show the full length of the contact). Viewed from within, the contact is found to be a synchondrosis, the strip of cartilage being wider below than above. The cartilage, however, does not extend through the full thickness of the suture; it is rather as though the little fissure had been "tuck-pointed" from within. This tuck-pointing has been continued right round the periphery of the epiotic, gives off short branches which extend between the prootic and opisthotic and between the opisthotic and exoccipital, and it acquires both breadth and depth of surface at the point of contact of the exoccipitals and epiotic bones in the mid-line. The epiotic bone forms the middle third of the posterior wall of the cranial cavity and an equal extent of the side wall at the same level. At the junction of the posterior and lateral external surfaces, the bone is produced into a prominent ridge, the epiotic process. This ridge commences on the parietal and is crossed near its upper limit by the suture between the

two bones. The cavity of the bone may be likened to the cast of a very flat cone, almost symmetrical. At the apex of the cavity there is situated the upper end of the bony canal for the posterior semicircular membranous canal; the lower end of this canal will be found perforating the cartilaginous tuck-pointing at the lower periphery of the bone.

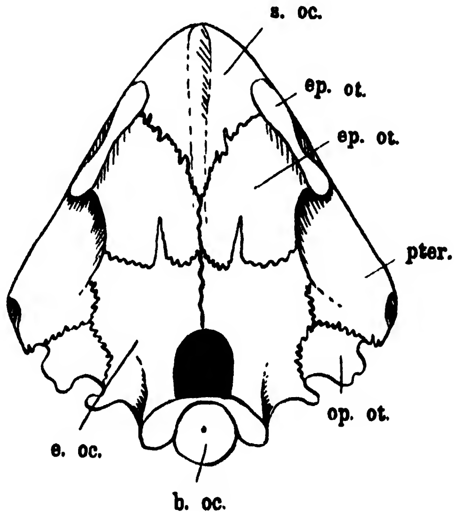

Fig. 12. *Cheilodactylus spectabilis* Hutton.

The *Exoccipital* bone presents the usual neural facet and superior vertical lamina and a quite small inferior vertical lamina. The extent of the superior vertical lamina is greater than usual, whilst the bone might appear to have invaded the side of the skull below the buttress only to place the nerve foramina in their correct situation. The superior vertical laminæ together surround the foramen magnum, meeting one another in the mid-line both above and below it. Contiguous to the foramen each lamina provides back and side walls to the cranial cavity and merges with the reduced otic mass which forms the median wall to the posterior cavum ampullæ. The lamina also provides the hinder wall of this cavum. As is usual the two exoccipital bones provide the hinder portion of the floor of the cranial cavity. Immediately in front of the anterior margin of this horizontal lamina the apparent floor of the cavity dips downward to the horizontal laminæ of the prootic bones. The spino-occipital foramen pierces the bone in the angle between the horizontal and superior vertical laminæ immediately within the foramen magnum, to appear on the outside on the side of the buttress of the neural facet. The vagus foramen pierces the bone in the same angle a little farther forward, and

appears on the outside just in front of the buttress. The small glosso-pharyngeal foramen is present immediately in front of the last. The azygos sinus is entirely devoid of roofing.

The hypomyodomial *Basioccipital* is, as usual in this type, laterally compressed, and the two cava sacculi are placed for the most part above the level of the hinder end of the myodome.

The *Opisthotic* is an irregular bone, which presents on the side of the skull below the pterotic process as a stout lamina of bone continuing that process downward; it also contributes to the side wall of the skull a small area in front of the vertical lamina of the exoccipital.

The *Sphenotic* bone presents on the outside of the skull as an outstanding postorbital process; closer examination discovers medial to this a quite appreciable postorbital surface which sutures with the postorbital lamina of the frontal, the alisphenoid, and prootic bones. It is flush with these bones, and with them makes a postorbital wall which is more extensive than is usual. Besides the postorbital surface there is also a temporal surface which contributes largely to the formation of the floor of the external temporal fossa. The postorbital process calls for further description. It is a laterally compressed lamina attached by its anterior margin to the outer edge of the postorbital surface. Broader below than above, it is slightly concave on its outer aspect at the lower end, this concavity being converted into a narrow trench as the upper end is reached. From the top end of this trench the otic canal passes down, inward and slightly forward to open near the centre of the postorbital surface, above and to the outer side of the anterior opening of the trigemino-facial foramen. The bone also contributes the upper half to the formation of the anterior facet for the hyomandibular, the suture between the prootic and this bone passing across the centre of the depth of that facet. Within the cranium the sphenotic appears as a roughly pyramidal hollow, above and in front of the opisthotic, which is crossed from above down and forward by a thin lamina of bone which divides its cavity approximately into two halves; of these the upper and anterior half is the internal temporal and the lower half is the arcuate fossa.

The *Prootics* present the salient features of these bones throughout the Teleostomi. They form the roof, side wall, and part of the floor of the myodome, the floors and part of the side walls of the cava sacculi, lodge the trigemino-facial ganglionic complex in the similarly named fossa, and form the cranial floor immediately behind the pituitary fossa. Externally the bone presents a myodomial wing and a postorbital surface. On the latter surface the foramina from the trigemino-facial fossa are recognisable on sight. Below these a spur of the bone extends downward to suture with an upthrown flange of the synpterygoid. To the inner side of

the trigemino-facial foramen is the abducent, and above that is the trochlearis foramen, perforating the alisphenoid bone. An antero-posteriorly flattened arch is thrown across over the V-VII foramen and is continued down, to suture with a similar, but thinner flange of the synpterygoid, thus forming the outer wall of the trigemino-facial chamber. The arch in question gives to the V-VII foramen the appearance of having anterior and posterior openings.

The *Pterotic* is an irregular compressed and dorso-ventrally elongated bone which presents on the lateral aspect of the skull to a much greater extent than it does internally. In this latter situation it appears as the deep conical cavity which lodges the ampulla of the horizontal membranous canal, and as the roof, anterior wall, and upper part of the posterior wall of the posterior ampullary cavity. The horizontal membranous canal is lodged in a bony canal which connects the depths of these two cavities. Above the middle ampullary cavity, between the epiotic and sphenotic bones, the pterotic is covered internally by cartilage.

Externally the pterotic bone presents a ridge which forms the posterior boundary of the temporal fossa. This ridge begins at the lower corner of an elevated triangular area at the postero-lateral angle of the frontal, where the suture between the frontal and pterotic marks the upper limit of the latter bone. At its lower end the ridge becomes swollen, and bears, almost at its antero-inferior corner, a tubercle for the posterior hyomandibular joint, and behind and a little above that the little cup-like facet for the articular head of the operculum. On either side of the ridge the epiotic contributes to the floors of the lateral and middle temporal fossæ.

The *Parietal* bone extends through the whole thickness of the skull. On the outer surface it appears as an irregular area behind the frontal, suturing with that bone and with the pterotic, epiotic, and supraoccipital. Internally it appears as a small area between the epiotic, supraoccipital, frontal, sphenotic, and the cartilage-covered portion of the pterotic.

The body of the *Basisphenoid* is peculiar in being in the vertical plane. It appears as a small stout forward wall to the pituitary fossa, articulating on either side with the alisphenoid and the inner edge of that spur of the prootic which extends down to suture with the synpterygoid. It is separated from the horizontal laminæ of the prootic bones by the pituitary fontanelle. The descending lamina of the bone is broadest above, with a peculiar little hook at the upper end just below its attachment to the body.

The *Alisphenoid* is a more extensive bone than usual; it contributes largely to the well developed postorbital previously noted. It sutures with frontal, parietal, sphenotic, prootic, and basi-sphenoid bones.

The *Frontal, Prefrontal,* the *Mesethmoid* and *Premaxilla,* are all so essentially similar to the same bones in *Epinephelus* that they do not call for separate description.

The *Synpterygoid* is so similar to that of forms already described that it may be dismissed with brief comment on the fact that ventrally it is markedly compressed from side to side and, as it were, squeezed into a keel. Mention should again be made of the vertical flange which crosses the bone below the arch over the V-VII foramen.

The *Nasals* are elongated spatulate bones firmly attached by fibrous tissue and fibro-cartilage to the mesethmoid and prefrontal bones at the proximal end, and standing out above the premaxilla, above, medial, and parallel to the upper edge of the first suborbital bone.

RECESSES.

The *Dilatator fossa* is very much larger and better defined, that is, more obviously defined, than usual. The lower boundary is the upper edge of the hyomandibular bone, when that is in position. When the hyomandibular is removed, the lower boundary is only a little less obvious. It is defined by the anterior facet and posterior tubercle for the two hyomandibular articulations and a ridge which joins these two articular structures. The anterior boundary is the postorbital ridge of the sphenotic bone, and the posterior boundary is the pterotic process. These two processes meet above; the latter, inclining forward, is continued to the former by the lower anterior edge of the raised triangular area on the frontal to meet the upper end of the postorbital process.

The *Temporal fossa* is bounded in front by the pterotic process and the outstanding flange of the opisthotic; posteriorly it is bounded by the epiotic process. A thickening of the parietal swings forward from the upper end of the epiotic process to meet the upper end of the posterior edge of the raised triangular area of the frontal, and this in turn is continued down to meet the upper end of the pterotic process.

The limits of the *Occipital fossa* are rather indicated than defined by the epiotic process and the vertical lamina of the occipital crest.

THE CRANIAL BOUNDARIES AND THE OTOCRANE.

The floor of the cranial cavity is raised at an angle of about forty-five degrees from the plane of the base line of the synpterygoid; this gives to the cavity an appearance of greater depth than usual. The floor within the foramen magnum is formed by the two exoccipital bones; the portion so formed is short and is per-

forated by the azygos sinus. Almost immediately forward of the sinus the exoccipital bones terminate, and there is a sharp dip to the horizontal laminæ of the prootic bones. From this point the floor rises evenly till the pituitary fontanelle is reached; in front of the fontanelle the basisphenoidal component of the floor rises vertically for a short distance. In front of this bone the median cranial flooring is provided by the spheno-obturator membrane.

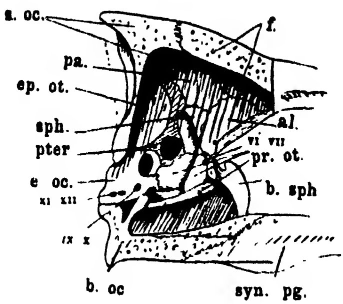

Fig. 13. *Cheilodactylus spectabilis* Hutton.

Behind the pituitary fontanelle the cranial floor appears to be wider than farther back; it is carried out on the anterior portion of the horizontal lamina of the prootic to the trigemino-facial fossa. The hinder wall of this fossa is a lamina of bone which continues downward that which has been described above as dividing the cavity of the sphenotic bone into two halves. From the median end of this bone a very slight ridge crosses the cranial floor to the median end of the opposite lamina. This ridge is of importance; to it there is attached, in the flesh, the anterior margin of a horizontal membrane whose posterior margin is attached to the anterior free edges of the exoccipital bone. The membrane forms the floor of the cranial cavity in this region and the roofs of the contiguous cava sacculi. The two saccular cavities are separated one from the other by a narrow vertical membrane which is attached above to that just described and below to the line of suture between the two prootic bones. The flooring membrane is not attached at the sides, but, curving upward, it extends both back and forward to form the inner wall of the otocrane. Its posterior margin is attached below to the exoccipital bone in front of the X foramen and behind the posterior ampullary cavity; passing higher it finds attachment around the periphery of the epiotic bone. It apparently did not reach quite to the roof of the cranial cavity, but passing down from the height of the epiotic it crossed the ribbon of cartilage between that bone and the parietal to reach the lamina which divides the cavity of the sphenotic; down this its

anterior margin is attached to the ridge on the horizontal lamina of the prootic with which we started.

The location of the posterior and horizontal membranous canals and their ampullæ has already been described. It would appear that the anterior membranous canal was lodged in the posterior cavity of the sphenotic and the groove below it formed by the descending lamina, the ampulla probably lying at the bottom of that groove.

The large size of the alisphenoid makes for a very complete anterior wall to the cranial cavity, and a much reduced sphenotic obturator membrane, the whole recalling strongly the anterior wall of a bird's skull.

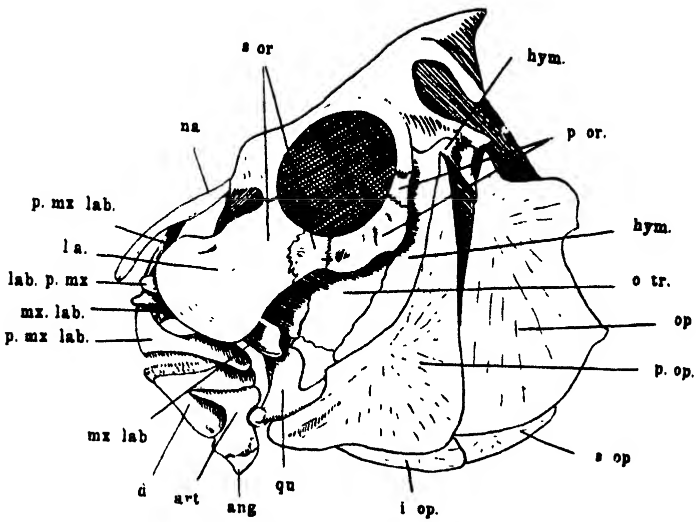

Fig. 14. *Cheilodactylus spectabilis* Hutton.

CIRCUM-ORBITAL BONES.

These are four in number. The anterior is very much larger than any of the others and extends well forward, overlapping the labial bones and forming a side wall to the nasal cavity. The second suborbital is similar to the two postorbital scutes. The form and arrangement of these bones recall that of *Epinephelus,* though in that form the first suborbital is not so large.

UPPER JAW AND PALATE.

The hyomandibular articulation is peculiar in that the posterior articulation is double. The usual two tubercles are present for articulation with the two facets on the skull, but, in addition,

there is developed immediately behind the posterior tubercle a well defined cup for articulation with an equally well developed tubercle on the lower end of the pterotic process (trinarticulate hyomandibular). All these articulations are lined by hyaline cartilage.

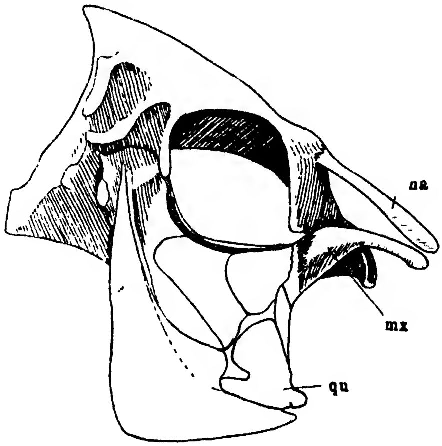

Fig. 15. *Cheilodactylus spectabilis* Hutton.

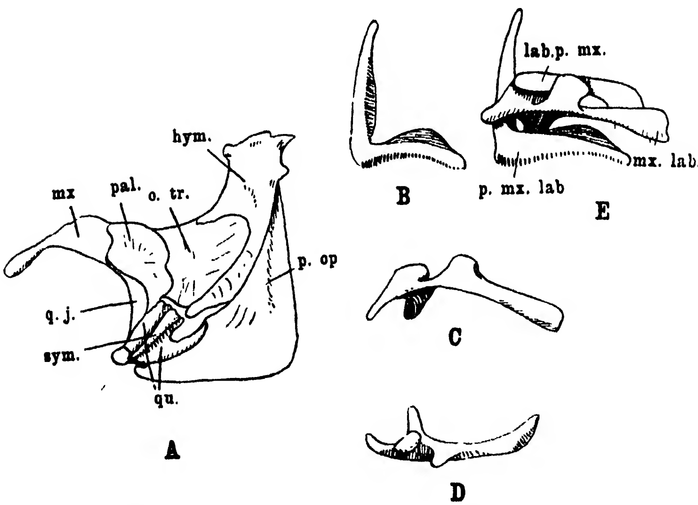

Fig. 16. *Cheilodactylus spectabilis* Hutton.

The remaining bones of the upper jaw and palate are in all essentials similar to those of *Epinephelus*, and as their form and relations to one another are fully shown in the drawings, they may be dismissed without further comment, beyond remarking that as in that genus the maxilla is monobisartete.

In the preceding pages three Percomorph skulls have been described in some detail, and one other is illustrated without description. In addition to these there are in my collection skulls from over thirty other Percomorph genera. Examination of these shows that they do not differ from those described in any essential details that cannot be adequately explained in a brief review, comparing them with those described.

It will facilitate this comparative review if types of reference be established at the outset.

(1) The *Sparid* type is exemplified in *Pagrosomus*, but that form is peculiar in the possession of the tremendous occipital and fused frontal mass. This type is laterally compressed and dorso-ventrally lengthened. With the bones of the upper jaw, palate, suspensorium, and lower jaw in place, it has the same general appearance as that of *Cheilodactylus*. Viewed from below, the bones of the visceral skeleton are all seen practically edge on. The occipital segment of the cranial cavity is constricted, though not so much as in the Serranid type. The basioccipital bone is hypomyodomial. The maxilla is monobisartete and the hyomandibular is binarticulate. The myodome is large and open below posteriorly.

(2) The *Girella* type is very similar to the last, but the skull itself is more rounded as viewed either from in front or behind. The basioccipital bone is paramyodomial.

(3) The *Cheilodactylid* type differs from the Sparid in that the occipital segment of the cranial cavity is not constricted, and correlated with this the posterior wall of the skull occupies more nearly the transverse plane, whilst that of the previous types slopes forward rather more than it spreads laterally.

(4) In the *Serranid* type we have the Girella type of skull proper elongated antero-posteriorly, and the visceral skeleton so spread out that, viewed from below, all the component bones are to be seen almost in full face. The basioccipital is paramyodomial; whereas in the preceding types the synpterygoid is keeled below, in this it is flat.

(5) The *Sphyræna* type of skull resembles the Serranid in contours, but there is a very marked elongation of the ethmo-nasal region of the skull, as it were a step half way to the Esox type of cranium, and as in *Esox* the maxilla is dibisartete.

Glyphisodon.—Sparid type, branchial tubercle well developed.

Achærodus.—Girella type.

Lutjanus.—Serranid type.

Etelis.—Serranid type, but the orbits are particularly large and the maxilla is dibisartete.

Scomber.—Girella type.

Sparus.—Naturally a Sparid type, but my particular species has a small boss at the base of the occipital bone which is not constantly present in *Sparus* itself and not typical of the "type" as here understood.

Sphyrena.—Sphyrenid type; the dilatator fossa is open to the orbit and the postorbital bone reduced to a splint, placed along the outer side of the fossa, and continuing downward and back the orbital margin. The labial process of the maxilla is short.

Alectis.—Sparid type; the occipital crest is continued forward to the mesethmoid bone by a frontal crest. The hyomandibular is binarticulate but almost plenarticulate. I have but one, rather poor, young skull for study of this form, and there is a hiatus in the roof of the cranium above the pterotic crest, between the parietal, pterotic, and frontal bones, and further, it appears that this form is monartete, but I am doubtful of this observation. The resemblance of this skull to the other two Carangidæ is such that I think the observed differences are due to the age and poor state of preservation of the specimen.

Caranx and *Ulua* are essentially similar to the last, differing only in the absence of the hiatus in the roof, and in the fact that the maxilla is monobisartete. Such is the resemblance of these three Carangids one to the other that I am tempted to establish a Carangid type, which would occupy a position between the Girella and Sparid types.

Percalates.—Girella type.

Cæsioperca.—Serrandid type.

Helotes.—Girella type. Apparently monartete to trabecula cornu, but I have but a single young skull and do not trust the observation.

Scolopsis.—Girella type.

Priacanthus.—Girella type.

Therapon.—One very young skull, apparently serranid in type.

Pentapus.—Here again I have but one quite small skull; it is apparently of Girella type.

Nemipterus.—Sparid type.

Upeneus and *Upenichthys* resemble one another and may be said to present a Mullid type. This is intermediate between the Serranid and Sphyrenid types, and, as in the latter, the maxilla is dibisartete. The ethmo-nasal region is longer than in the Serranid, but shorter than in the Sphyrenid.

Crinodus, Platax, Dactylophorus are Cheilodactylid in type.

I have also material for the study of *Scatophagus, Psettus, Teuthis* and *Drepane,* but these differ from those already dealt with to an extent that calls for more detailed description. I may, however, state that if those already dealt with may be deemed typical Percomorph skulls, *Drepane* and *Scatophagus* may not, whilst the skulls of *Teuthis* and *Psettus* present a closer approximation to the typical form.

I hope to describe these four forms at a later date.

EXPLANATION OF PLATE XXXII.

Fig. 1. *Myriothela australis*, Briggs. Drawing of the holotype from Maroubra Bay, near Sydney, New South Wales.

Fig. 2. *Myriothela australis*, Briggs. Drawing of a young specimen devoid of gonophores and showing the method of attachment to the lobes of the thallus of a seaweed.

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2

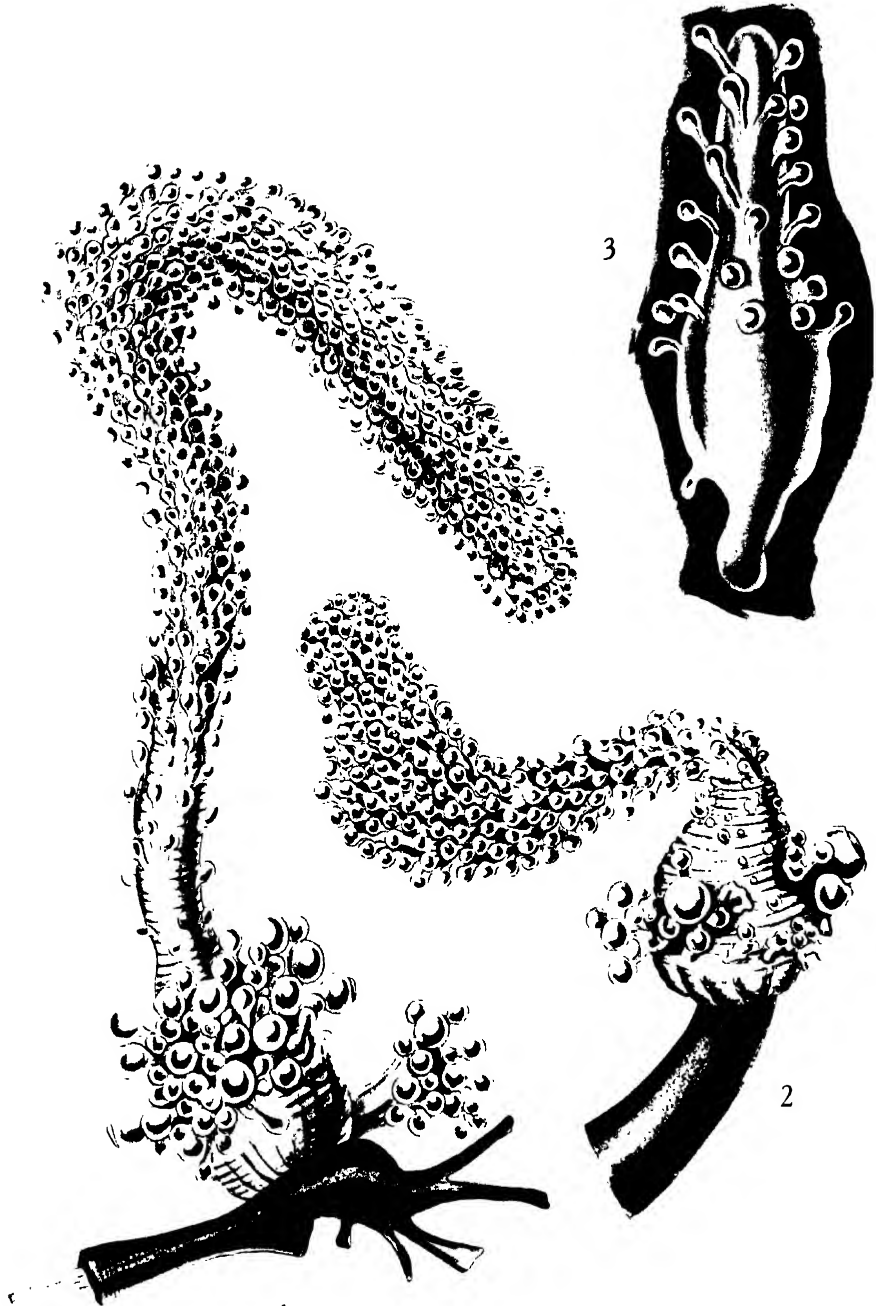
DOROTHY HARRISON, del.

EXPLANATION OF PLATE XXXIII.

Fig. 1. *Myriothela harrisoni*, Briggs. Drawing of the holotype from Bulli, forty miles south of Sydney, New South Wales.

Fig. 2. *Myriothela harrisoni*, Briggs. A specimen from which some of the blastostyles have been removed to show the form of the blastostyle-bearing zone.

Fig. 3. *Myriothela australis*, Briggs. Very young specimen, 4 mm. in height.



DOROTHY HARRISON, del.

EXPLANATION OF PLATE XXXIV.

Fig. 1. *Myriothela australis,* Briggs. Longitudinal section of a tentacle from the tentacle-bearing zone of the hydranth, showing the great thickness attained by the supporting lamella in the capitulum. × 260.

Fig. 2. *Myriothela australis,* Briggs. Longitudinal section of a tentacle from the extremity of a blastostyle, showing the comparatively thin supporting lamella in the trumpet-shaped capitulum. × 260.

Fig. 3. *Myriothela australis,* Briggs. Transverse section through the stalk of a tentacle from the tentacle-bearing zone of the hydranth. The longitudinal muscle fibres are seen on the outer side of the supporting lamella. × 260.

Fig. 4. *Myriothela australis,* Briggs. Transverse section of the body-wall of the hydranth in the middle region of the tentacle-bearing zone. The supporting lamella is very strongly developed and gives off closely placed thin, either single or branched, secondary lamellæ which stretch out through the whole of the hyaline portion of the ectoderm. On each side of these secondary lamellæ there is attached a layer of well-developed longitudinal muscle fibres. × 525.

Fig. 5. *Myriothela harrisoni,* Briggs. Section through the distal pole of a male gonophore showing the apical opening representing the velar aperture. × 550.

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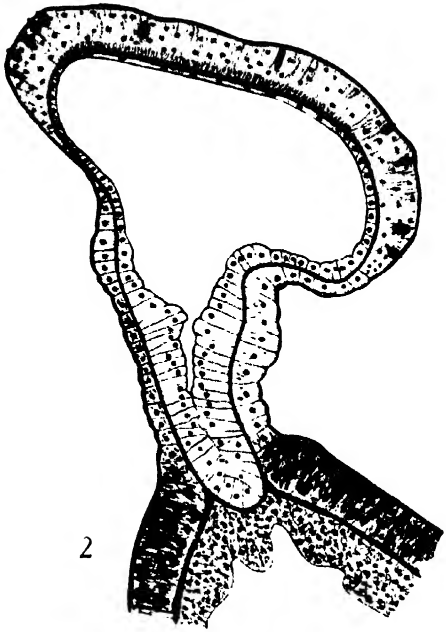

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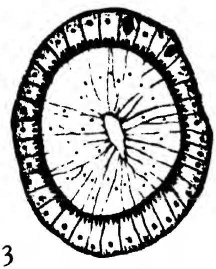

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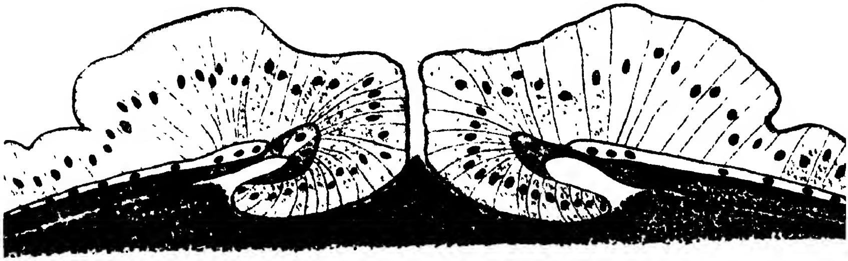

E. A. BRIGGS, del.

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